NEW YORK SEATTLE

MOTORSHIP

Devoted to Marine Oil Engine and Motor Vessels

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EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

MOTORSHIP

PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

(Trade Mark Registered)

Vol. VIII | New York, U. S. A., August, 1923 | No. 8

(Cable Address—Freemote, New York)

A BRITISH COLUMBIA DIESEL-POWERED TUG

This 55 ft. towboat RADIO has been towing logs since she went into commission about five months ago, and has demonstrated to the fullest satisfaction of the owner the remarkable economy of the oil-engined boat as compared with steam or gasoline towboats on the West Coast. Fuel and lubricating oil cost about 21 cents an hour on the basis of British Columbia prices

Converted MILLER COUNTY On Maiden Voyage

First of the American-Built Opposed Piston Engines Put Into Commission Aboard Ship

WITHOUT any shop trials the Sun-Doxford Diesel engine, developing 3,000 b.h.p. at 90 r.p.m., was installed in the tanker MILLER COUNTY, which is now on her maiden voyage after brief river trials which were completely successful.

The MILLER COUNTY was originally completed in 1920 for the Emergency Fleet Corporation and powered with a steam turbine. She was purchased last year by the Sun Shipbuilding & Dry Dock Company, her present owners, who have converted her to a motorship by substituting one of the Sun-Doxford Diesel engines for her original steam turbine equipment. She has been chartered by the Sun Oil Company, of Philadelphia, and later fixed for four trips to California for account of the Standard Oil Company.

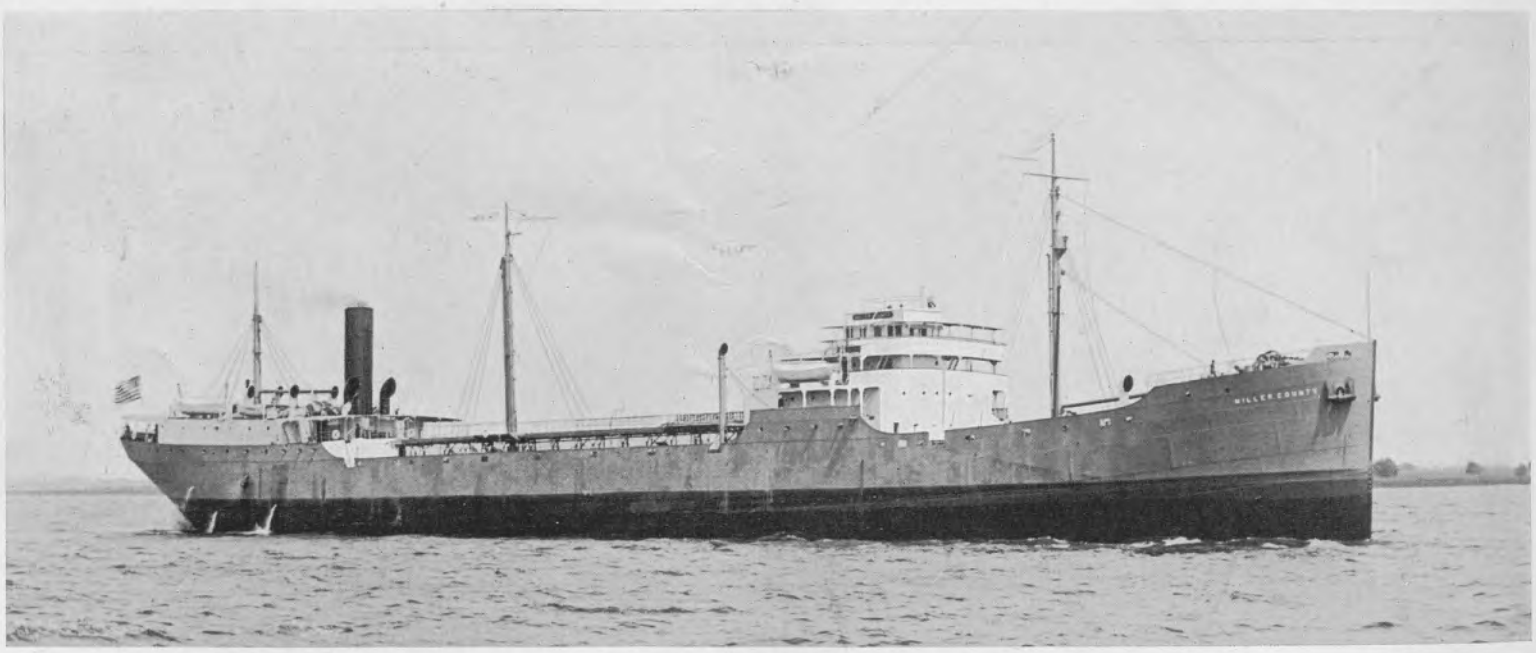
This vessel, which has a loaded displacement of 14,760 tons, will furnish a very instructive comparison between the cost of operation of a steamer and of a motorship, so far as the main machinery is concerned. All the steam auxiliaries originally installed have been retained, and since they will, of course, eat up their usual large amount of fuel they will to that extent detract from the economical showing of the Diesel engine as a propelling unit.

It is understood that the Sun Shipbuilding & Dry Dock Company would recommend Diesel power auxiliaries on a new vessel, the steam auxiliaries having been retained in this instance only for the purpose of reducing the capital cost of the conversion. The CHALLENGER, which is another vessel now undergoing conversion at the same yard, will, on the contrary, have an entirely new equipment of Diesel-electric auxiliaries.

The new Sun-Doxford Diesel engine of the MILLER COUNTY is a four-cylinder set of the well-known double opposed-piston type with a bore of 22¾ in. and a stroke of 45½ in. This engine was turned over for the first time the day before the ship was pulled out into the river for her first trial, on which it developed that there was a critical speed at around 40 r.p.m., but there is no undue vibration at 65 r.p.m. and over. This critical speed is not of any real importance, because it will not show in ordinary operation of the vessel. It could, of course, be removed at any time if the owners should so desire.

The engine handles very well, and so far as one can judge from the performance of the trial trip, conforms to the good expectations that have been held for this type of engine.

Class and Society	A. B. S. & Lloyds
Length (b.p.)	430′ 0″
Breadth (moulded)	59′ 0″
Depth (moulded)	33′ 3″
Loaded draft (mean)	25′ 4½″
Displacement (loaded)	14,760
Displacement (light)	4,500
Dead-weight-capacity of ship	10,260
Shaft horsepower	3,000
Engine speed (r.p.m.)	90
Cylinder bore	22¾″
Piston stroke	45½″x2
Propeller diameter	17′ 9″
Propeller pitch	13′ 9″
Name of Builder of Ship	Baltimore Drydk. Co.
Name of Eng Bldr.	Sun Shipbldg. & Drydk Co.



Converted tanker MILLER COUNTY with Sun-Doxford Diesel engines. The smoke is from the auxiliary boiler

Fifth Motor Tanker for Tankers, Ltd.

HAVING already four motor-tank vessels, all of which have been constructed by Vickers and fitted with their four-cycle airless-injection type of engine, Tankers, Limited, a London Company, recently took delivery of the fifth vessel for its fleet.

This new ship, the SCOTTISH BORDERER, is a twin-screw vessel with Sulzer Diesel engines built by W. Denny & Bros., Ltd., of Dumbarton, Scotland. Her principal dimensions are: length b.p. 425 ft. 0 in., moulded breadth 56 ft. 8 in., and moulded depth 33 ft. 0 in.

Cargo is carried in 18 main oil compartments, the aggregate capacity of which totals about 10,000 tons of heavy oil. The summer tanks are fitted in the wings between the main and upper decks, these being utilized when the cargo is gasoline. A small hold is fitted forward for case oil or other dry cargo.

The two Sulzer engines have four cylinders 23⅝ in. diameter and 41 11/16 in. stroke, from which, at 100 r.p.m. a shaft horsepower of 1,250 is developed. When in shallow ports or rivers the cooling water is filtered before use. It is interesting to record that the forced lubrication system employed throughout the engine provides for a pressure of 300 lbs. per sq. in. at the crosshead pins, a separate pump being provided for this part of the system.

Engine-room auxiliaries and cargo pumps are steam driven. The fuel-consumption is expected to be between 11 and 12 tons daily when the vessel is fully laden and maintaining a speed of between 10½ and 11 knots—this figure including the oil burned under the auxiliary boiler. When the vessel is at sea the only steam needed is for a small lighting dynamo and for the steering engine, all the pumps being driven off the main engines.

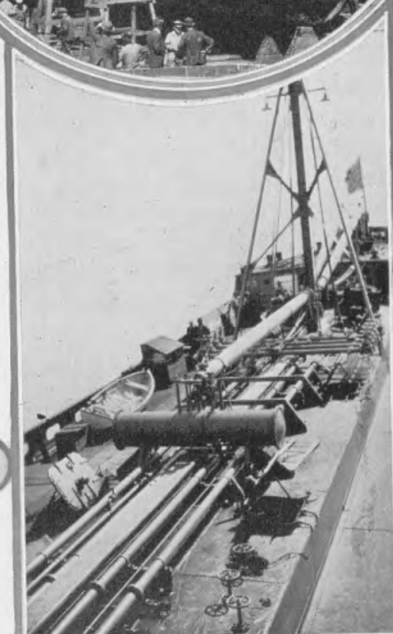
In the new motor tanker of 6,450 tons d.w.c. ordered by the Stoomvaart Maatschappij de Maas (Phs. van Ommeren), of Rotterdam, the six-cylinder, four-cycle Burmeister & Wain type of engine will be installed. This vessel is building at the yard of the Rotterdamsche Droogdok Maatschappij, and will measure 370 ft. b.p., 53 ft. moulded breadth and 28 ft. moulded depth. She will be built on the Millar system of framing.

Changes in Second Diesel-Electric Tanker for Standard Oil Co. of California

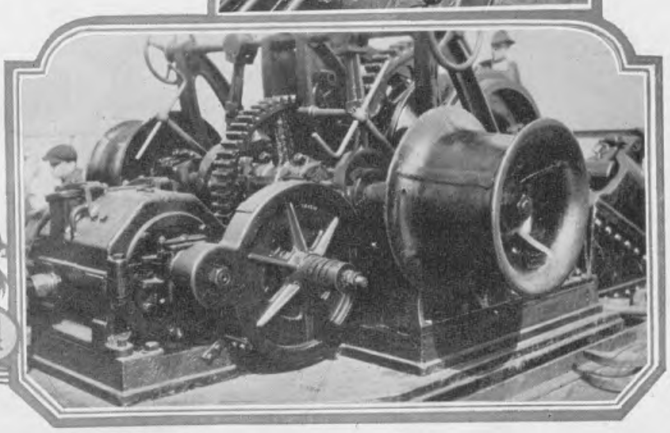
AFTER the satisfactory showing made by their first Diesel-electric tanker STANDARD SERVICE on her trials, the Standard Oil Company of California placed an order with the same builders for what is virtually a duplicate vessel. The new boat, which has not yet been named, is designed particularly for the Alaskan trade. To meet the increasing demand for Diesel fuel in stationary engine plants in Alaska, the new boat will have an arrangement permitting her to carry Diesel oil in one of her tanks, of which she will have five, in place of four that were provided in the STANDARD SERVICE.

The fifth tank, instead of having its own cargo pump as the others have, will be filled or discharged either by one of the four cargo pumps belonging to the other tanks or by the fuel-oil transfer pump in the engine-room.

Another alteration is in the cargo winch controls. The cargo winches, which are used also for the purpose of handling the cargo hose, were located on the expansion trunk of the STANDARD SERVICE, with their controls alongside. Though in the new boat the winches will remain in the same position, the electric controls will be located on the forecastle head, thus permitting the operator to look straight down into the cargo hold without leaving the controls. Everything else will be the same as in the STANDARD SERVICE.



1. M. S. STANDARD SERVICE, the first Diesel-electric tanker of the Standard Oil Company of California, described on page 345 of our May issue. 2. Bow view in drydock. 3. Arrangement of derricks. 4. One of the electric cargo-winches. 5. Location of motor winches on the expansion trunk



Motors Reliable In Port and At Sea

Lochgoil's Steady-Running Engines Eat Up the Miles—Equally Reliable Maneuvering in Port

LOCHGOIL, the Royal Main Steam Packet Co.'s 14,000-ton 13-knot motorship, Capt. G. F. Huff, a sister ship to the LOCH KATRINE and to several vessels of the R. M. S. P. Co.'s associates, the Holland-American Line, operating on the run from United Kingdom and Continental ports to the Pacific Coast of America, is maintaining the record for reliable performance set by her sister ships already in commission, and reports a very satisfactory performance on her last trip out to Vancouver, B. C. Chief Engineer Helps, who brought the first of the R. M. S. P. motor vessels, the LOCH KATRINE, out on her maiden voyage, was on the LOCHGOIL this trip, and stated that she was performing very well.

On the run from the Continent to the Pacific Coast of America she had averaged 13 knots, and coming up the coast had passed two 15,000-ton tank steamers that were rated as 15-knot ships. On another occasion, leaving Portland, some anxiety was felt about being able to keep ahead of a Shipping Board steamer which they were told was a 15-knot ship, but when they finally got clear of the river the other vessel was barely in sight.

Her chief said that, when running in company with steamers, while the motorship kept an unvarying speed, the steamers would slow down toward the end of a watch, and then gradually pick up as the next watch worked up steam again. On the run up the coast from Portland to Seattle the LOCHGOIL was fairly light, and in particularly good trim. Under these favorable conditions she averaged 14 knots.

These R. M. S. P. motorships on the Pacific run are all equipped with twin eight-cylinder four-cycle Burmeister & Wain type Diesel engines. They maneuver and make their landings in port without the assistance of tugs, using a small launch to take the lines ashore when necessary.

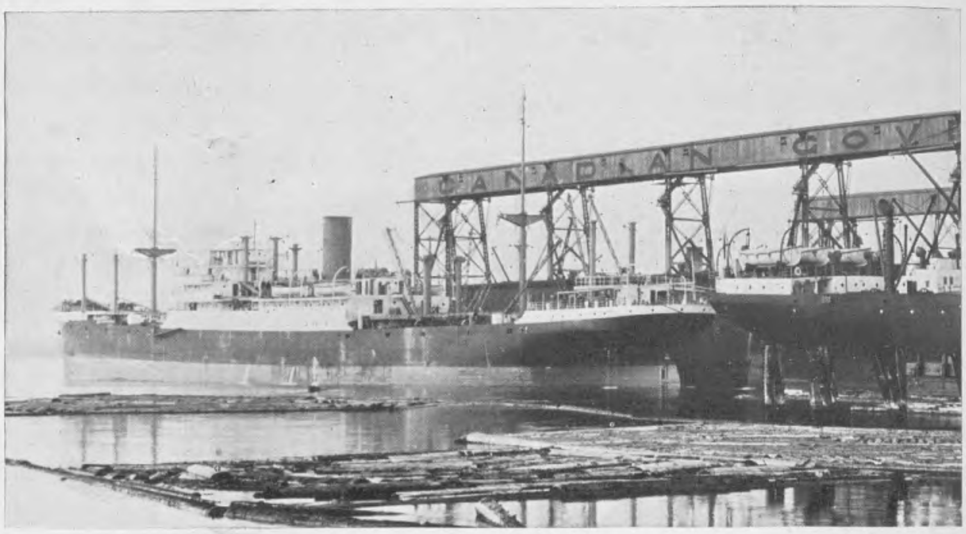
On her call at Vancouver, B. C., in July, the LOCHGOIL was maneuvered into a particularly awkward berth under her own power, the ship responding perfectly to the demands made on the engines. The position was such as might have been thought up by the examiner of a candidate for a pilot certificate, and Capt. Huff made sure of having Capt. Bachelor, a veteran of the Vancouver pilotage service, to do the trick.

The LOCHGOIL got orders to move from the C. P. R. pier, where she had been loading, to the Government Grain Elevator pier, where there were already three steamers loading, the cross berth at the head of the pier being occupied by a C. G. M. M. steamer, the eastern side by another steamer and most of the western side by a Blue Funnel boat loading logs.

There remained a 250-ft. berth astern of the Blue Funnel steamer, which had the inshore berth, and at this berth it was planned to lay the 500-ft. LOCHGOIL, starboard side to, in order to work the after hatches, leaving about half the ship's length projecting beyond the pier and the bow of the C. G. M. M. steamer into the stream.

There was about a knot or more of easterly current, which caused the anchors to drag when dropped to hold up the ship's head while her stern was being warped alongside the pier. When she had been maneuvered into position with lines ashore to hold the stern, and with the anchor at the bow, the change of the tide assisted in holding her alongside. The maneuver was completed entirely with the ship's own engines and winches, except that a small launch carried the lines ashore.

Together the R. M. S. P. and Holland-American Line are now operating four motorships of this class on the run to the Pacific, and the LOCH MONAR and another of this class at present under construction will follow shortly, some of the steam tonnage now on the run being retired.



M. S. LOCHGOIL at her berth at the Canadian Government's Grain Elevator Pier at Vancouver, B. C., when she demonstrated her handiness in maneuvering

Pacific Steam Navigation Co.'s Motorship

THROUGH the purchase of four motorships from the Glen Line, the Pacific Steam Navigation Company has become one of the leading motor-vessel owners. The sale of these ships by the Glen Line is more or less of a formality because the new owners belong to the same financial group as the Glen Line does. The new names for the ships are LAGARTO, LARETO, LORIGA and LANTARIO, which were formerly known respectively as the GLENAVY (5,075 tons gross), GLENADE (6,802 tons) GLENARIFFE (6,795 tons) and GLENGYLE (6,225 tons).

At the beginning of July the Pacific Steam Navigation Company took over from Harland & Wolff, Ltd., a new first-class twin-screw motorship, to be known as the LAGUNA, which is classed 100A1 at Lloyds and is 430 ft. long by 54 ft. moulded breadth and 36 ft. moulded depth, with a gross tonnage of about 6,500 tons. The new vessel has three complete steel decks, poop, bridge and forecastle decks, and there are eight watertight bulkheads dividing the ship into nine compartments.

The propelling machinery consists of two six-cylinder, four-cycle Diesel engines of Harland & Wolff's standard design on the Burmeister & Wain system, developing about 3,200 i.h.p. together, and giving the vessel a speed of about 11¼ knots at sea. In addition to the accommodation provided for the captain, officers, engineers, and crew (60 all told) there is first-class accommodation for 12 passengers. All the accommodation is heated by electric vapor radiators. The galley range and baker's oven are oil-fired, so that no coal whatever has to be carried on the vessel. Steam is used only for the fire extinguishing installation fitted throughout the vessel and for heating and scouring the oil tanks, and is supplied by an oil-fired boiler.

All the auxiliary machinery on deck and in the engine-room is electrically-driven. Fuel is carried in a tank occupying the space between the tunnels in No. 3 hold and can also be carried in the double bottom compartments, which can alternatively be employed for water ballast. Fresh water is carried in the after peak while the fore peak is for water ballast only. There are six cargo holds and cargo space between decks. No. 4 hold is arranged as a deep tank for water ballast when required. The hatchways are large, and there are four derricks to each hatch,—24 derricks in all fitted to four derrick posts. The capacity of these derricks is from 5 to 10 tons, and on the after side of the foremast a heavy derrick is provided suitable for lifting 40 tons.

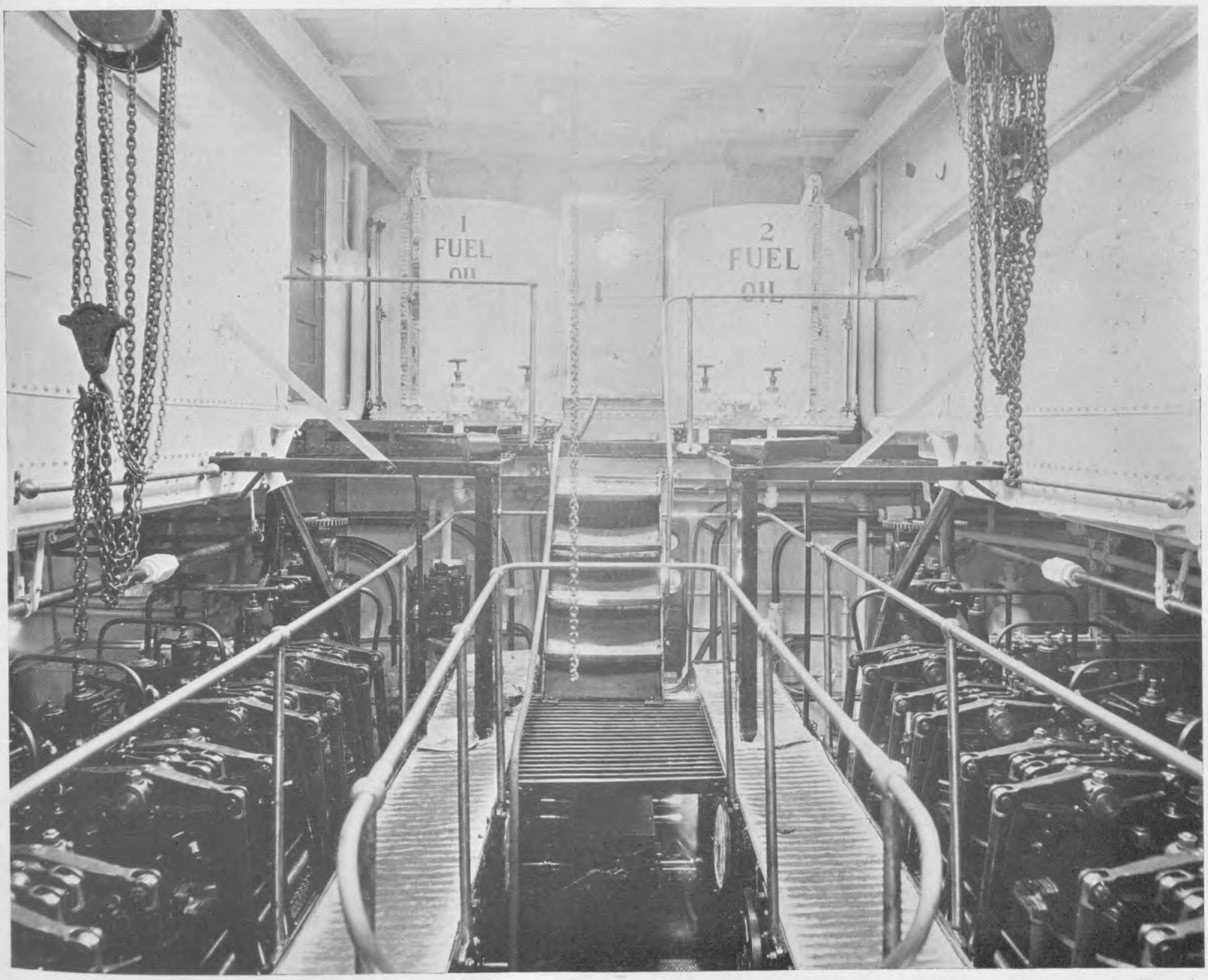
TROY-SOCONY, the new Diesel-engined barge of the Standard Transportation Co.

Motor Tanker for N. Y. State Barge Canal Service

Diesel Engined Vessel to Carry Bulk Oil from the Coast to the Great Lakes

AN excellent type of tank barge has recently been commissioned by the Standard Transportation Company, one of the Standard Oil group. This boat, which has a deadweight capacity of 1,800 tons and is driven by two McIntosh & Seymour engines of 300 b.h.p. each, has sufficient power to make headway on outside voyages and thus has a greater value than if it were designed solely for canal work. The details of the boat have been admirably thought out, and it is believed that when she is in service she will be found to have maximum efficiency in discharging or taking on cargo so that the minimum time is spent at the dock. This boat has the following dimensions—

Class and Society	A.B.S.
Length (b.p.)	254′ 0″
Breadth (moulded)	37′ 6″
Depth (moulded)	14′ 0″
Loaded draft (mean)	12′ 0″
Displacement (loaded)	2,500 tons.



Excellently proportioned engine-room of the TROY-SOCONY seen from the upper grating

Another view of the TROY-SOCONY which gives a suggestion of her breadth proportions

Dead-weight-capacity of ship . . 1,800 tons.
Shaft horsepower 600 (2-300)
Ship's trial speed . . . . 10 miles.
Propeller diameter . . . . 6′ 0″
Name of Builder of Ship . . . . Sun Shipbldg. & Dry Dock Co.
Name of Engine Builder . . . . . McIntosh & Seymour.

This is the first Diesel-engined boat in the Standard Transportation Company's service during the last ten years. In the earlier days of oil-engine development in this country a Diesel-engined barge was built to the order of this firm for work on Long Island Sound. The engine proved unsatisfactory, because it was of immature German design, and was later replaced by a surface-ignition engine that performed well. With the McIntosh & Seymour engines there is surety that the Standard Transportation Company will meet with success on this occasion and become firmly wedded to the motorship for future boats that they build.

The TROY SOCONY, as she is named, will be one of the finest vessels on the New York State Barge Canal. During the first trip to Buffalo the boat showed itself well adapted to the difficult handling inseparable from canal work.

20,000 Ton Ships for R.M.S.P. Company

ANNOUNCEMENT that two large motor liners have been ordered from Harland & Wolff, Ltd., by the Royal Mail Steam Packet Company, with the aid of a loan of about $15,000,000 furnished by the British Government, has led to various conflicting reports. The tonnage of these vessels has been quoted between 18,000 and 23,000 tons and the horsepower up to 14,000. In view of the varied statements that have appeared, we give the following information:

There are three vessels for the Royal Mail Steam Packet Company now on order with Harland & Wolff, Ltd. The yard numbers of these will help to make the position clear:

No. 507, on which a start has been made, is one of the big ships.

No. 517, laid down some months ago, is a motorship of 9,500 tons, somewhat similar to those built for the Glen Line.

No. 586, which is yet to be laid down, is the second of the big ships.

The following statement has been issued by the Northern Ireland Government:

"Proposals for the issue of a guarantee by the Northern Government, in connection with the construction of three ships for the ownership of the Royal Mail Steam Packet Company, have been under the consideration of the Loans Guarantee Advisory Committee for some time, and that Committee has recommended to the Ministry of Finance the issue of a guarantee, on the same terms and conditions as the proposed guarantee of the Imperial Government.

"The respective amounts to be guaranteed by the two Governments cannot be definitely stated at the present time, but will depend upon the expenditure incurred in Great Britain and in Northern Ireland respectively.

"The total cost of the three ships will not, it is anticipated, fall far short of £3,000,000 ($13,800,000).

"The amount of the guarantee recommended to the Imperial Treasury by the Trade Facilities Committee—viz.: £2,300,000 ($10,000,000)—is a maximum figure, and this amount may be varied, i. e., the sum to be provided under the guarantee of the Government of Northern Ireland may be increased, and the sum under the guarantee of the Imperial Treasury decreased proportionately."

Speaking later on the same subject, the Prime Minister of Northern Ireland said guarantees have been issued in respect to the three ships at somewhere in the region of $6,000,000, while the British Government had fixed a maximum of about $10,500,000 on the same vessels. These amounts, he stated, were capable of adjustment, and he hoped that it might be possible to manufacture in Belfast a larger proportion of the machinery required, which would then enable the Government of Northern Ireland to increase its guarantee, thus assisting in the employment of more men.

He added that the facilities of the Loans Guarantee Act had been in the main afforded to the shipbuilding industry, but were available for all industries. It appears, therefore, that the Royal Mail Steam Packet Company is not getting a direct shipping subsidy, but is availing itself of facilities being afforded by the Governments in Great Britain and Ireland, for the reduction of unemployment.

The two big vessels are to be named the ASTURIAS and AMAZON respectively. The actual dimensions and engine power have not been officially announced, but we learn from our own correspondent that in all probability these boats will be larger than any motorships yet ordered, and will be equipped with double-acting Diesel engines of the Burmeister & Wain type.

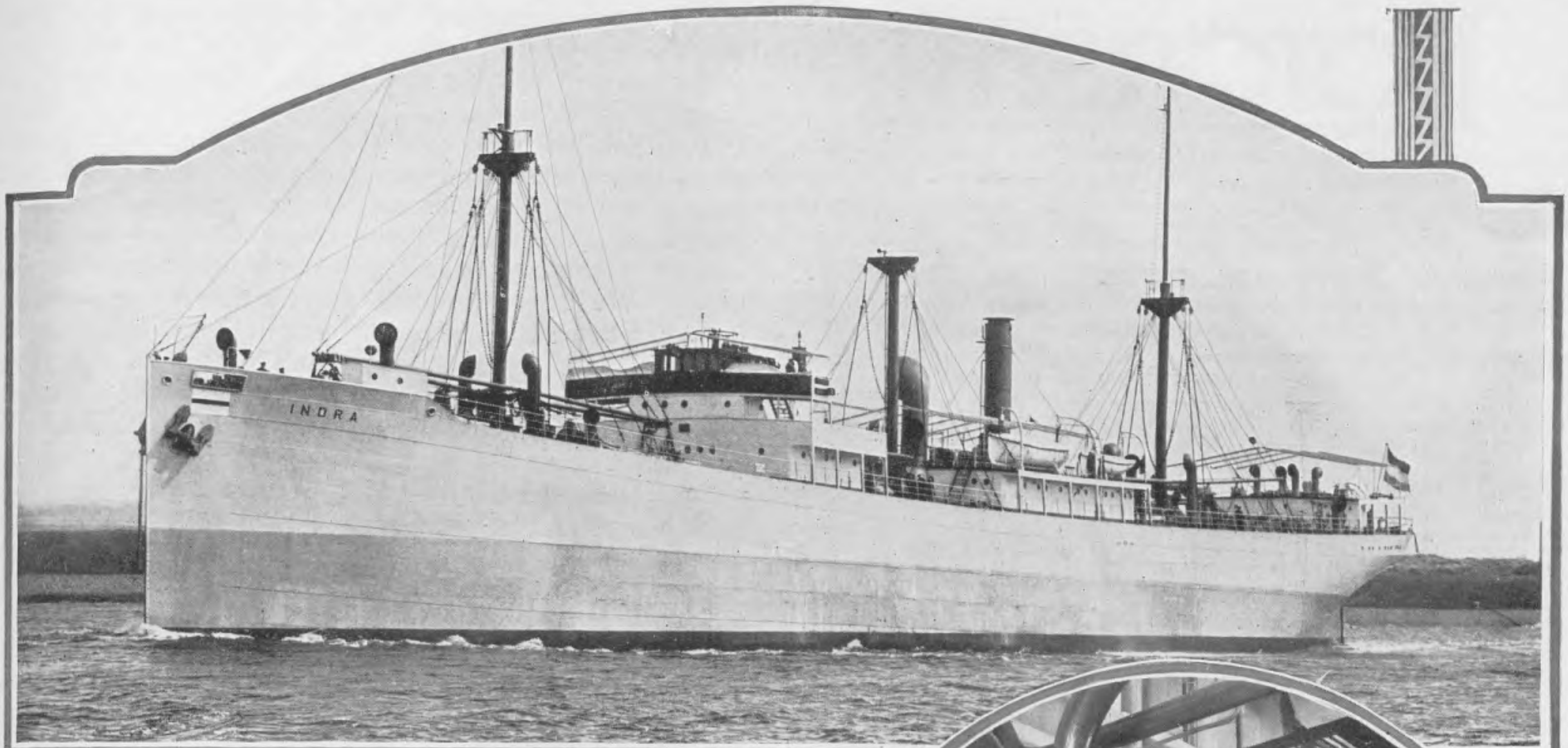
New Engines for Furness-Withy on Test

SYCAMORE, one of the new motor ships under construction for Furness-Withy & Co., Ltd., Liverpool, for the Mediterranean service, was launched a couple of months ago, and her engines are now undergoing tests under the supervision of a special committee appointed by the Institution of Mechanical Engineers, the Institution of Naval Architects, the Institute of Marine Engineers, and the British Admiralty. These engines are of the Beardmore-Tosi type, constructed by Richardson Westgarth & Co., and have each six cylinders of 24⅜″ diameter and with 38⅜″ stroke. They will each develop about 1,500 i. h. p. at 125 r. p. m.

These are the first engines to be submitted for the test of the special British committee which was appointed some time back for the purpose of conducting trials of various types of marine Diesel engines.

Mr. B. B. Morrison, Chairman and Managing Director of Richardson Westgarth & Company, was the man who first made the suggestion for this series of official trials, and it is therefore fitting that his engines should be the first to go under official observation. The tests will later be continued at sea.

The SYCAMORE is 363 ft. long, by 52 ft. beam, by 26 ft. 11 in. moulded depth, and is of 6,000 tons dead weight.



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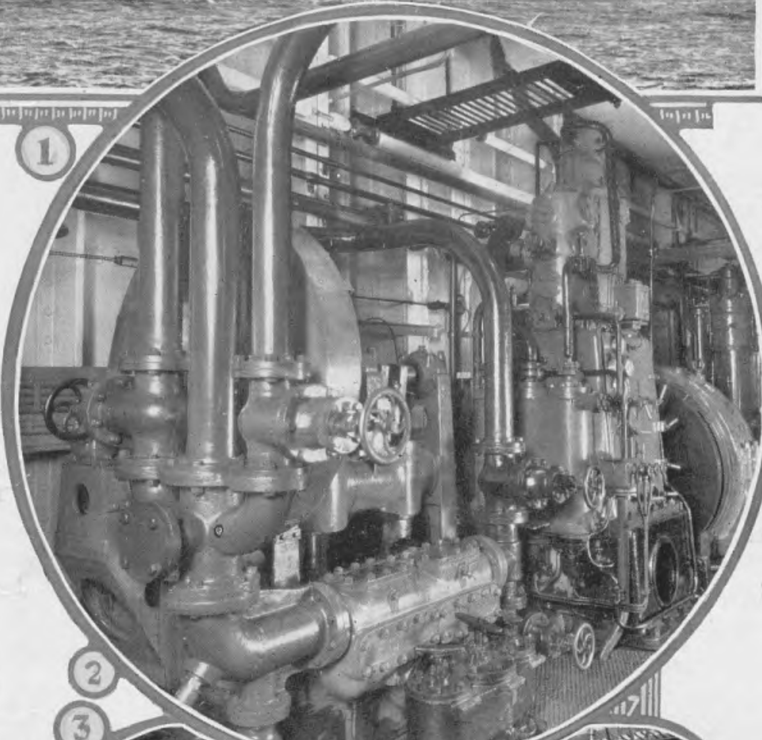

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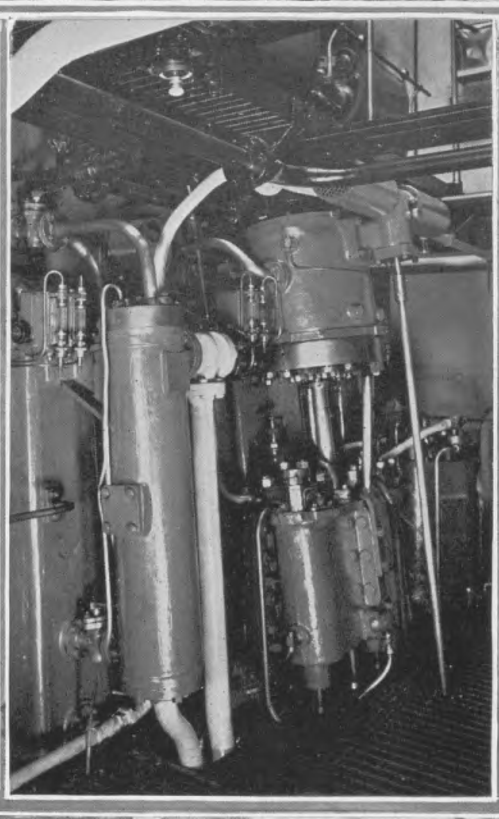

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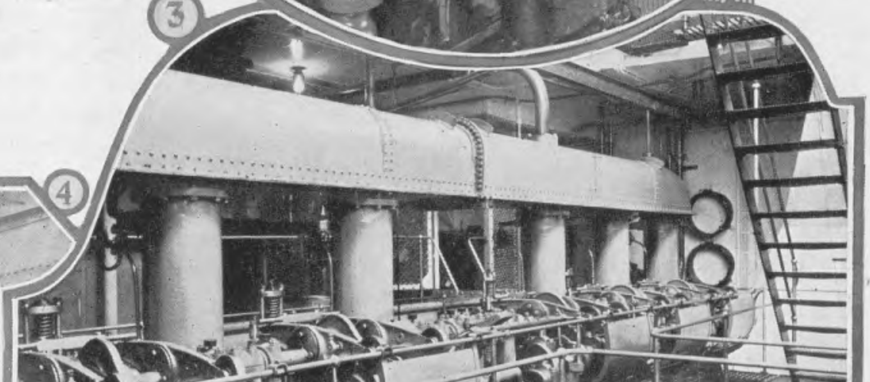

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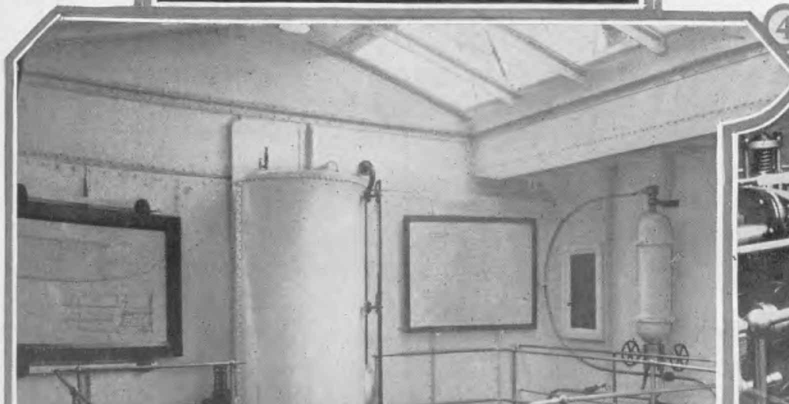

1. M. S. INDRA, built for Winge & Co., Christiania, 7,000 tons d.w.c., with twin Werkspoor engines of 1,100 i.h.p. each, recently ran trials. 2. Auxiliary compressor and pumps. 3. Top view of one of main engines. 4. Daily fuel tank and, on the right, the accumulator on the injection fuel line. 5. Main air-compressor at back of engine

MOTORSHIP

Trade Mark, Registered

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WORLDWIDE INCREASE OF MOTORSHIP BUILDING

ACCORDING to the shipbuilding returns just issued by Lloyd's Register for the quarter ending June 30th, 1923, the popularity of the motorship is increasing with notable rapidity. Lloyd's figures take into account all vessels of over 100 tons register upon which construction has actually been commenced. The present total for the world is 765 ships of all types measuring 2,543,856 tons gross. About 15 per cent. of this is motorship tonnage, the motor vessels now under construction numbering 131 with a gross tonnage of 387,936. There are 10 motorships of 24,245 tons gross building in this country, which is exceeded by Great Britain with 48 motorships of 221,274 tons, by Germany with 15 motor vessels of 46,330 tons, and by Sweden with 11 motorships of 37,085 tons gross.

The shipbuilding figures for Great Britain, which are given in detail, are very instructive. For instance, although the total tonnage of vessels under constructon in that country has decreased by 27 per cent. since June 30th, 1922, the motorship tonnage has *increased* about 13 per cent. and now represents one-fifth of the total tonnage building in the United Kingdom. If we take only the vessels between 4,000 tons and 10,000 tons gross we find that the motorships represent one-third.

FUTURE OF AMERICAN SHIPPING AS SEEN BY A SCANDINAVIAN MOTORSHIP AUTHORITY

IN the course of an address presented to the Scandinavian Shipping Conference a note of warning was given by E. L. Barfoed to the shipowners of Northern Europe who have hitherto been the leaders in the substitution of motorships for the far less economical steamers. Barfoed pointed out that other nations which were at first slow to adopt the new type of vessel are making up for lost time and are showing an almost feverish anxiety to replace their steamers by motorships on the long runs. He apparently had in mind British and Dutch shipowners. His thoughts on American shipping were expressed in another way. Dealing with the problem of the American Merchant Marine he stated:

"One must especially be prepared for great surprises from the United States and not be duped by the apparently sharp condemnation by American owners, especially with the oil burning turbine boats, about which one hears and reads everywhere. The Americans have now, in the highest sense, got an understanding of the tremendous advantage of the Diesel ship, and the low oil prices will, for American ships provided with Diesel engines, have the effect that they, even although they have large and expensive crews and less experienced managers, will beat the coal burning ships right out of the freight market."

We wish we could echo the opinion Barfoed expressed about the understanding which America now has of Diesel engines for ship propulsion. The statement is true so far as it applies to private shipowners, but it does not, unfortunately, represent the case with the United States Shipping Board. We believe, however, that the time is fast approaching when those upon whom the responsibility has been laid for reducing the losses on the nation's investment in shipping, will adopt the motorship conversion program which each retiring Chairman of the Shipping Board has recommended, but which each Chairman in turn had failed to adopt during the period of his active work for the Government.

Ex-Chairman Lasker's statement, in his letter to the President upon retiring from the Board, to the effect that motorships could be operated at 25 per cent. less than steamers, appears to have made a deep impression upon political circles at the Capital. Some of those in touch with under-currents at Washington profess that the Shipping Board will ask Congress for authority to convert 30 or 40 steamers as a first step towards the motorization of our Merchant Marine.

WATCH SUBMARINE PROGRESS ABROAD

ALMOST no attention has been given by the newspapers to the recent launching in Great Britain of the biggest submarine that has yet been built by any country in the world. It is easy to understand that the British Navy, relieved of the necessity for striving to get ahead of other navies in the design of its capital ships, should direct its technical efforts towards the improvement of those classes of war vessels which are outside the restriction of the Washington five-power agreement.

What is difficult to understand, however, is the indifference of our press to developments of that sort, which are of vital importance to our first line of defence. Unless the country is educated to the strides that are being made by other navies, it is impossible to expect that Congress will vote money for development work along these lines in the United States Navy.

The building of the big British submarine, and the mystery with which it has been shrouded, is an event of the first magnitude in naval development. It should have been made known to everyone who has a vote, and the significance of it should have been sufficiently explained to make every voter feel that not a single dollar could be appropriated by Congress to better purpose than in furnishing money to the Navy Department, not merely for matching British submarine progress, but for out-matching it.

Already in the June issue of MOTORSHIP, on page 417, we called attention to this powerful new unit of the British Navy. We stated then that its surface displacement is 2,780 tons and its submerged displacement 3,800 tons. Those figures apparently have to be corrected slightly. It has been given out since in England that the submerged displacement will be 3,600 tons, and the surface displacement 2,600 tons.

The largest German submarine put into service was the U-142 of 2,200 tons submerged displacement—we believe—which has only been excelled by another British submarine, namely, the K-26, which was recently completed and is of 2,770 tons submerged displacement. No figures have been given out on the other side about the engine power, speed, or armament of the British new submarine which is designated X-1 and was built in one of their Navy yards. It is known only that the estimated cost was $3,770,000. That figure, which is official, was exclusive of armament and stores. The probability is that twice as much money would be needed to build the same type of vessel over here.

Diesels Discussed by Verein Deutscher Ingenieure

Status of the Diesel Engine Was Chief Topic of Discussion at Big Meeting of German Engineers in Berlin

A NUMBER of interesting addresses, dealing with the oil engine, were presented at the Berlin meeting of the German national engineering society on June 29th, last. Special arrangements had been made for the presentation of a number of papers dealing with this type of engine and with the problems of its development. In summary these represent the present state of German opinion on this branch of engineering.

A well known authority on the Diesel engine, Dr. Nägel, delivered the chief address. His review started with the state of the art in 1911, which was the year in which the German engineers last dealt with the same subject at their annual meeting. The further development of this primemover from that time he outlined, and he considered also the four principal directions in which progress has been made:

1. The adaptation of the design to economy of material, chiefly through increased revolutions.
2. The introduction of the two-cycle system.
3. The introduction of airless injection.
4. Improvement in the means for the burning of heavier fuels.

Referring to the first point, the paper discussed new designs of engine frames. Valuable experience in that direction was gained with the development of the high speed engines for submarines, and this has had a considerable influence upon the designs of present day German engines.

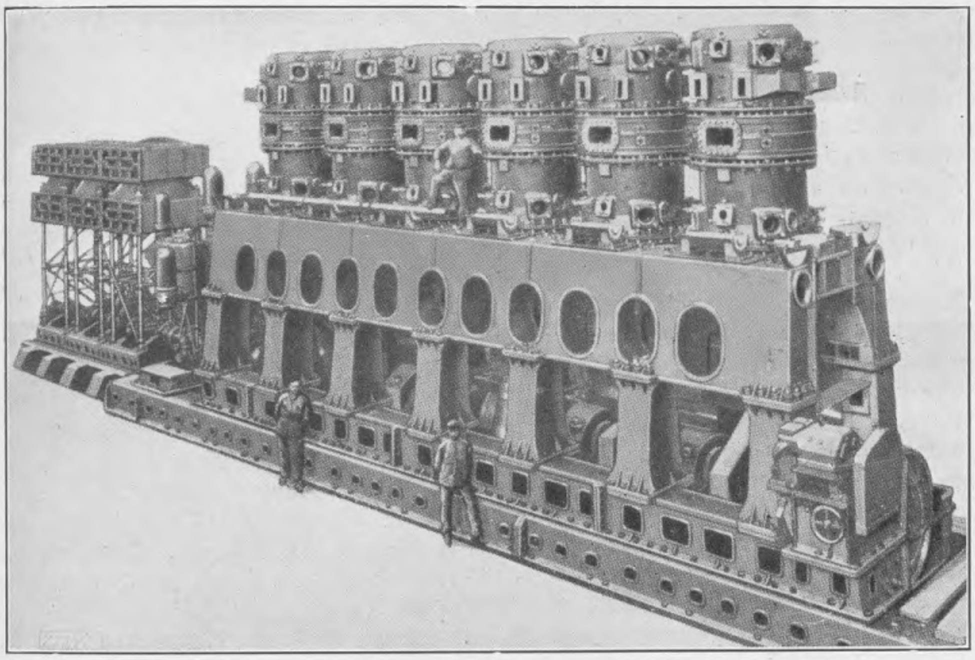
Stress was laid upon the desirability of producing Diesel engines on a quantity basis, this being particularly important in connection with the smaller powered engines.

In applying the two-cycle principle to large engine units, the valve-scavenging type of engine was employed at the start, but results have shown that the port-scavenging type presents greater advantages. This speaker made the first public mention that has been given to the 12,000 h.p. two-cycle engine built by the M.A.N. Company at Nuremberg for the German navy. The work started about 1910, and only half of the engine was erected for the preliminary trial. The engine was only completed just prior to the war. Under one of the clauses of the Versailles Treaty, an interallied commission demanded the junking of this engine set, which is, therefore, unavailable for further tests.

It is noted that Sulzer's, in their latest big engines at the Ludwigshafen works, have obtained fuel consumption figures on their two-cycle engines which are stated to be as low as the best that have been shown by a four-cycle engine. Dr. Nägel added the very interesting statement that the Augsburg works of the M.A.N. Company, which for thirty years had been faithful adherents of the four-cycle design and which looked with disfavor upon the earlier development of the two-cycle engines at the Nuremberg Works of the same company, has recently developed a new two-cycle design intended for double-acting engines of the largest size. Very promising results are reported to have been obtained on trial engines.

Referring to the airless injection engine, the speaker pointed out the difference in the cost of production when the compressor is abolished and expressed the opinion that the same method of fuel injection will eventually be adopted on most large engines.

Great efforts have been made of late years to enable Diesel engines to burn heavier oils than those which have hitherto been used with success. He regarded the two-cycle port-scavenging engine as particularly suited for the combustion of the heavier fuels. He mentioned also a piston design which is being developed by Krupp's, with the aid of which coal-tar oils have been successfully burned under no load conditions in engine trials at Essen.



This huge Diesel engine, capable of developing 12,000 shaft horsepower, was built at Nuremberg, Germany, before the war and was intended for trial in a capital ship of the German Navy. It is a two-cycle double-acting engine, with six cylinders of 33-7/16 in. diameter and with a piston stroke of 41⅜ in., designed to run at 160 revolutions per minute

On the subject of the transmission of heat in the internal combustion engine, another speaker, Dr. Nusselt, summarized the conclusions to which he had been led by a series of tests carried out with ball-shaped bombs for testing the cooling of hot gases. The heat passes into the cold wall of the bomb partly by heat conduction and partly by heat radiation. In order to separate the influence of these two factors, Dr. Nusselt blackened the inner surface of some bombs and gilded the inner surface of others. The difference in the rate of transmission of the heat in the two cases is proportional to the radiation of heat from the hot gases of combustion.

It has been shown that the heat radiation from hot gases increases with the fourth power of the absolute temperature, but on the other hand it has also been shown that the heat radiation from an absolutely black body at the same temperature is only about one-fifteenth of that of the bright body.

The heat delivered by conduction depends both on temperature and on pressure. By making use of the tests of Dugald Clerk on a gas engine, the influence of the travel of the piston on the heat given up has been taken into consideration. Applying the new formula to the transmission of heat in the combustion engine, it will be seen that radiation is very far from playing the important part formerly ascribed to it. The assumed relation between the co-efficient of heat transmission and the mean piston speed is only approximate. Further tests will, before long, afford further data about the co-efficient of heat transmission in engines.

Comparative tests made between fuel injection, with and without the aid of blast air, carried out at the University of Hanover, were reviewed by Dr. Neumann. He dealt with the difficulties encountered in substituting airless injection for ordinary air injection, and determined that airless injection under equal conditions requires extraordinarily high pressures and very small nozzle diameters.

For these tests the same engine was used throughout the trials and the influence of the engine design was, therefore, excluded. The results showed the speed of combustion of the different oils and indicated that with high pressure oil engines several ignitions generally occurred, and further that it is of the utmost importance that the first partial ignition shall take place in a proper time and at the proper place.

He further reported tests made with airless injection engines of different sizes and at varying engine speeds. The combustion

(*Continued on page* 576)

Marine Standardization Committee Ready for Action

Lists of Membership of Committees Already Appointed Promises Effective Work

AT a recent meeting in New York of the Executive Board of the American Marine Standards Committee, every provision was made for carrying out in detail the important work of simplification and standardization in the shipping industry. Great credit is due Secretary Hoover of the Department of Commerce for starting and sponsoring this movement in every industry in his campaign on the "Avoidance of Waste." Many branches of the manufacturing industry have started this work and it is particularly gratifying that shipping, in which maximum efficiency is an absolute necessity, has succeeded, largely through the efforts of Colonel E. A. Simmons, in enlisting the services and coöperation of our most prominent naval architects, marine engineers and ship operators.

Without the coöperation of the best men in the field, the movement would have no chance of success. This was fully realized, and great care was also taken in preparing the constitution and rules to prevent the possibility of any standard being adopted that had not received the most careful and authoritative consideration.

In order to do this, the Executive Board has divided the work among technical committees, who in turn will appoint subject committees for specific items. When a standard has been developed as far as the tentative stage by a subject committee, it then goes to the technical committee under which it is working, and, if passed by that body, will then be forwarded to the Secretary. He will promptly submit an outline of the standard to all concerns interested and invite their comments. The proposed standards, together with comments received in a reasonable time, will be submitted by the Secretary to the Executive Board. The Board may order further study and send it back to its technical committee with comments, or it may do one of three things, namely:

1. The Board may, by a favorable majority vote of all its members, approve it as *Suggested American Marine Practice;* or,

2. It may, by a favorable two-thirds of all its members, approve it as a *Tentative American Marine Standard;* or,

3. It may, by a favorable three-fourths vote of all its members, approve it as an *American Marine Standard*.

The votes of the Executive Board upon any proposed standard will be obtained by ballot.

Having shown how standards will be developed, it is appropriate to explain how individuals, companies, societies, government departments, and all either directly or indirectly concerned, can secure membership and take part in the work of the Organization.

Mass Membership is divided into two divisions, those who contribute funds or direct service and those who only coöperate in technical work. From these two classes of member bodies there is drawn the representative membership from and by which the members of the Executive Board will be taken and elected.

The present Executive Board, every member of which is widely known, is constituted as follows:

Chairman,

Colonel E. A. Simmons, President, American Marine Association, 30 Church Street, New York City, represents the American Marine Association.

Vice-Chairman,

Captain R. D. Gatewood, U. S. N., Manager of Department of Maintenance and Repair, Shipping Board Emergency Fleet Corporation, 45 Broadway, New York City, represents U. S. Shipping Board.

Members:

Charles F. Bailey, Engineering Director, Newport News Shipbuilding & Dry Dock Company, Newport News, Va., represents Shipbuilders for Engineering Details.

Hugh P. Frear, Naval Architect, Bethlehem Shipbuilding Corporation, Bethlehem, Pa., represents the Atlantic Coast Shipbuilders Association.

E. H. Rigg, Naval Architect, New York Shipbuilding Corporation, Camden, N. J., represents the American Society of Naval Architects and Marine Engineers.

William Francis Gibbs, Gibbs Brothers, Inc., 1 Broadway, New York City, represents the American Steamship Owners' Association.

Captain C. A. McAllister, Vice-President, American Bureau of Shipping, 50 Broad Street, New York City, represents the American Bureau of Shipping.

Captain John F. Milliken, Secretary and Treasurer Neptune Association, 21 Pearl Street, New York City, represents Masters, Mates and Labor Organizations.

Rear Admiral J. D. Beuret, U. S. N., Chief of Bureau of Construction and Repair, Navy Department, Washington, D. C., or Rear Admiral Robert Stocker (CC) U. S. N., Bureau of Construction and Repair, Navy Department, Washington, D. C., represents Bureau of C. & R., Navy Department.

Admiral J. K. Robison, U. S. N., Chief of the Bureau of Engineering, Navy Department, Washington, D. C. or Captain J. T. Tompkins, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C., represents Bureau of Engineering, Navy Department.

Brigadier General H. Taylor, U. S. A., Corps of Engineers, United States Army, War Department, Washington, D. C., represents Corps of Engineers, U. S. A.

General George Uhler, Supervising Inspector General, Steamboat Inspection Service, Department of Commerce, Commerce Building, Washington, D. C., represents U. S. Steamboat Inspection Service.

John W. Gray, Assistant to General Manager, Newport News Shipbuilding & Dry Dock Company, Room 410, Harrison Building, Philadelphia, Pa., *or* H. H. Brown, Managing Editor, Marine Engineering & Shipping Age, Simmons-Boardman Publishing Company, 30 Church Street, New Street City, represents American Society of Mechanical Engineers.

The Technical Committees that have been appointed to supervise simplification and standardization are as follows:

COMMITTEE ON HULL DETAILS.

Chairman,

W. A. Dobson, Naval Architect, William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.

Members:

E. L. Stewart, Naval Architect, Standard Oil Company (N. J.), Marine Department, 26 Broadway, New York City.

W. R. Bean, Assistant Naval Architect, New York Shipbuilding Corporation, Camden, N. J.

A. R. Brown, Naval Architect, Sparrows Point Plant, Bethlehem Shipbuilding Corporation, Sparrows Point, Md.

J. W. Hudson, Naval Architect, Sun Shipbuilding Company, Chester, Pa.

H. F. Norton, Naval Architect, Newport News Shipbuilding & Dry Dock Company, Newport News, Va.

Axel Rossell, Chief Constructor, Gibbs Brothers, Inc., 1 Broadway, New York City.

Commander H. S. Howard (CC) U. S. N., in charge of New Design, Bureau of C. & R., Navy Department, Washington, D. C.

Horace H. Thayer, Consulting Naval Architect, 119 South 4th Street, Philadelphia, Pa.

Hugh P. Frear, Naval Architect, Bethlehem Shipbuilding Corporation, Limited, Bethlehem, Pa.

COMMITTEE ON ENGINEERING DETAILS.

Chairman.

A. A. Howitz, Chief Engineer, Sun Shipbuilding Company, Chester, Pa.

Members.

Charles P. Weatherbee, Vice-President Bath Iron Works, Limited, Bath, Me.

M. L. Katzenstein, Manager, Marine Department, Worthington Pump & Machinery Corporation, 115 Broadway, New York City.

W. W. Smith, Chief Engineer, Federal Shipbuilding Company, Kearny, N. J.

J. B. Crew, Chief Engineer, New York Shipbuilding Corporation, Camden, N. J.

R. Warriner, Chief Engineer, Bethlehem Shipbuilding Corporation, Quincy, Mass.

James S. Milne, Chief Engineer, Todd Shipyards Corporation, 25 Broadway, New York City.

John F. Metten, Chief Engineer, William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.

Commander S. M. Robinson, U. S. N., Head of Design Division, Bureau of Engineering, U. S. Navy Department, Washington, D. C.

Charles F. Bailey, Engineering Director, Newport News Shipbuilding & Dry Dock Company, Newport News, Va.

A. E. Ballin, President, McIntosh & Seymour Corporation, Auburn, N. Y.

A. B. Homer, Marine Engineer, Bethlehem Shipbuilding Corp., Bethlehem, Pa.

COMMITTEE FOR SHIP OPERATION, DETAILS AND SUPPLIES.

Chairman,

A. S. Hebble, Superintending Engineer, Southern Pacific Lines, Pier 49 N. R., New York City.

Members:

R. F. Hand, Assistant Manager, Marine Department, Standard Oil Company (N. J.), 26 Broadway, New York City.

Walter L. Green, Jr., Superintending Engineer, Luckenbach Steamship Company, 44 Whitehall Street, New York City.

H. M. Wesson, Superintending Engineer, United American Lines, Incorporated, 39 Broadway, New York City.

W. B. Ferguson, Superintendent of Construction, Newport News Shipbuilding & Drydock Co., Newport News, Va.

N. J. Pluymert, Marine Superintendent, Standard Transportation Company, 26 Broadway, New York City.

P. H. Harwood, Marine Manager, Pan-American Petroleum & Transportation Company, 120 Broadway, New York City.

George B. Drake, Manager Marine Department, Texas Company, 17 Battery Place, New York City.

Captain Henry M. Seely, Supervising Inspector 2nd District, Steamboat Inspection Service, Customs House, New York City.

John W. Gray, Assistant to General Manager, Newport News Shipbuilding & Dry Dock Company, Room 410, Harrison Building, Philadelphia, Pa.

H. C. Higgins, District Agent, Division of Operations, U. S. Shipping Board Emergency Fleet Corporation, Philadelphia, Pa.

Captain H. L. Wyman, U. S. N., Assistant to Chief of Bureau of Engineering, U. S. Navy Department, Washington, D. C.

L. B. Shuman, Principal Assistant Engineer, U. S. District Engineer's Office, Witherspoon Building, 1321 Walnut Street, Philadelphia, Pa.

Two other committees are yet to be appointed; namely, the committee on Port Facilities and that on Manufacture and Construction.

The Secretary of the organization is A. V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

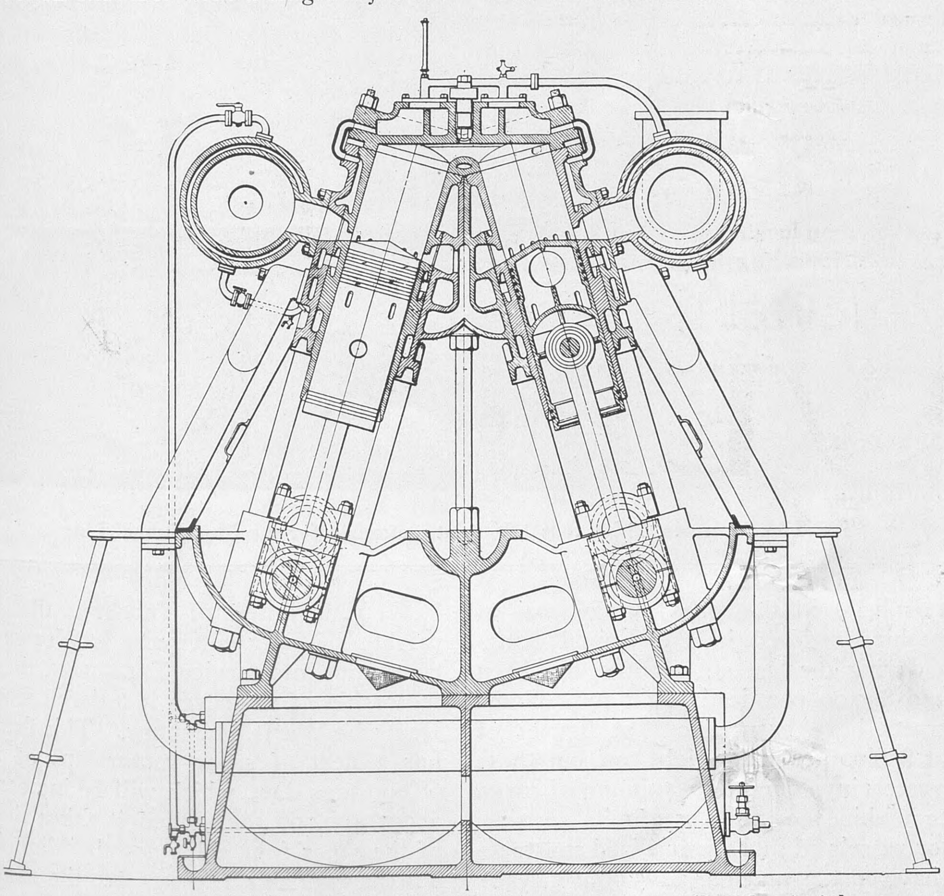
A special committee was appointed at the recent meeting of the Board with power to designate specific subjects to be taken up by the Technical and their Subject Committees.

A Novel Design of Diesel Engine

DEVELOPMENT has progressed sufficiently far on the new Knudsen type Diesel engine to permit a brief reference to be made of some of its novel features. We have been acquainted for a long time past with the progress of the work, but the designer has shunned publicity until now, when he has completed the building of a second engine embodying refinements of design which were suggested by his experience with the first engine he built of 120 b.h.p. The new engine is intended to develop about 200 b.h.p.

The outstanding departure from orthodox practice is the adoption of an inverted V-arrangement of the cylinders and pistons. Each pair of V-cylinders has a common combustion chamber with a single injection valve and starting valve. The connecting rods drive parallel crankshafts, one on each side of the engine as shown in the accompanying sectional view. At the after-end the two crank shafts are geared down to a single tail shaft, the speed reduction being in the ratio of 3.8:1.

Operating on the two cycle principle, this engine permits a very effective scavenging arrangement to be adopted with the exhaust ports in one cylinder and the scavenge ports in the other, so that the scavenge air sweeps right through each pair of dual cylinders. An airless system of fuel injection has been adopted which has simplified the engine considerably by reason of the absence of a multi-stage compressor. This in addition to the absence of camshafts, inlet and exhaust valves, etc., makes for a design with relatively few working parts. Separate fuel pumps are used for each combustion chamber. The compression is about 400 lbs. per sq. in., when the engine is cold, and increases about 40 lbs. after the engine is warmed up.



Section through new type of inverted V-engine operating on Diesel principle

In this style of construction the designer has sought to make not only a reduction in weight, but also compactness and the use of small cylinders. The weight of the 200 b.h.p. engine recently completed is not lower than of some other makes of engines of about the same size using the same crank shaft speed, but is relatively quite low, being about 65 lbs. per shaft horsepower. The four pairs of cylinders have a diameter of 6½″ with a 9″ stroke The crankshafts rotate at about 400 revolutions per minute, which is brought down by the reduction gearing to about 110 revolutions per minute on the tail shaft.

It is to be noted that there is no fundamental novelty in the adoption of a combustion chamber with dual cylinders. The simplest expression of this is exhibited in the designs of the Junkers type. It has also been used by the Weser company in Germany with vertical cylinders side by side. The Knudsen engine, however, so far as we are aware, shows the first example of this combination of cylinders and combustion chambers in an inverted V-design.

The engine can be seen at the works of the Knudsen Motor Corp., 984 Grand Street, Brooklyn, New York.

W. H. Allen, Sons & Co., Ltd., of Bedford, England, who have long been known for the excellence of their high-speed steam engines and later for their steam turbines, have now taken up the construction of the Burmeister & Wain design of Diesel engine under license from Harland & Wolff, Ltd., of Belfast. Special machine tools and layouts have been installed for this new branch of work, and specially designed erecting shops and test houses have been built with the most up-to-date equipment.

Research on Fatigue of Metals

End of Third Year's Work Shows Progress Being Made Towards Conclusions

ENGINEERING FOUNDATION, established by the four leading American Engineering Societies for the furtherance of research in science and in engineering, has recently issued its annual report for the eighth year of its operation. This report contains the following interesting summary of the research, which is still continuing, into the important subject of the fatigue of metals:

"Operations have continued at the Engineering Experiment Station of the University of Illinois under the supervision of Professor H. F. Moore, with the counsel of the Advisory Committee of the Division of Engineering of the National Research Council, Dean M. S. Ketchum, of the College of Engineering, and Professor A. N. Talbot, in charge of theoretical and applied mechanics, being the executive representatives of the University. Work under the original agreement with the General Electric Company was completed and the agreement extended. The University continues its generous contribution of services and facilities. A second progress report in condensed form is an appendix to this annual report.

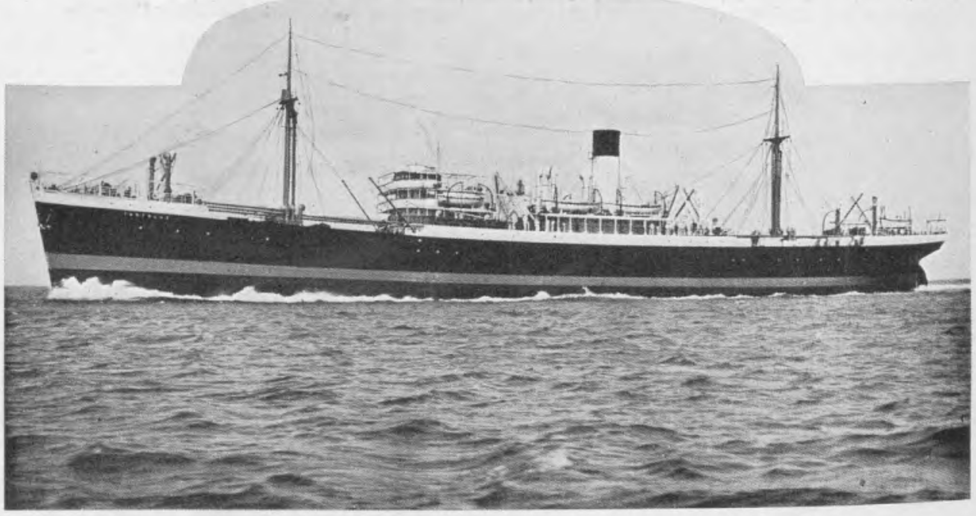
"For more than three years this quest has continued for fundamental reasons for the puzzling failure without warning of machine parts subjected to frequently repeated loadings, of springs, automobile and car axles, crankshafts, elevator and hoist ropes, steel rails. Fatigue, or progressive, failures are not new, but with increased use of high-speed equipment have become more numerous. Many tests were made during the seventy years preceding this investigation, and their results are still valuable, but they are insufficient for the needs of today. The outstanding gain so far from the present investigation is the determination that there exists an endurance limit under reversed stress as one of the physical characters of wrought ferrous metals, just as there is an ultimate tensile strength. The endurance limit, as defined by Professor Moore, is that stress below which metal can withstand an indefinitely large number of complete reversals of stress. Have all metals an endurance limit? Possibly there are metals which do not possess this character—some of the non-ferrous group, such as some of the copper alloys, for example? This question has been raised: What is its significance as to certain uses of these alloys in the arts?

"This investigation has not discovered the endurance limit, according to Professor Moore, but has given it a reasonably firm basis as a most significant property for a metal which must withstand repeated stress. Repeated stresses occur in many places where they are unsuspected, due to causes not at first apprehended—incidental bendings oft recurring, frequent moderate temperature changes in highly stressed objects.

"Of great importance to users of high-speed machinery is the detection by non-destructive means of the start of fatigue, or progressive failures. A railway car axle or the crankshaft of an engine has been in service five years. How can one determine whether there exist in it those minute cracks which are the forerunners of a break? Various methods have been proposed, but this field of inquiry is almost unworked. Much yet remains to be learned about the fatigue phenomena of metals in general, particularly about non-ferrous metals and castings of iron or steel. The results already made public have been widely commended. The General Electric Company has expressed high satisfaction with the quality and economy of work done for it, the results of which are being contributed to the general stock of information.

"Fatigue phenomena investigations are being carried on also in the Naval laboratories at Annapolis and in a few laboratories in the industries. So far as has been learned, these investigations are not duplicating, but supplementing and confirming, this cooperative project. The continuance of the experiences, the Advisory Committee of experts, and the special equipment, assure a quality and volume of results at low cost which would not soon again be possible, if the present combination were disintegrated before the major task can be completed. Industries to be benefited should, however, bear a share of the cost, if they would have the valuable information which it seems possible to obtain."

At the end of June the new motorship TANTALUS of 10,000 tons cargo capacity was turned over to her owners, Alfred Holt & Company (Blue Funnel Line). She is one of the largest and highest powered motorships afloat, and her twin-screw engines developing over 6,000 h.p. on trials gave her a speed of over 13½ knots. All the deck gear, including the steering, is electrically driven. The engines are of the Burmeister & Wain type, and the fuel consumption is expected not to exceed 20 or 21 tons daily. The Line will have an excellent opportunity for comparing operating costs by reason of the fact that the TANTALUS is similar to other vessels owned by the same company, in some of which geared turbines are installed and in others reciprocating steam machinery. The vessel has accommodation for about a dozen passengers.



TANTALUS, a new 10,000 tons 13½ knot motorship for the Blue Funnel Line

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A twin screw motor ferry boat for account of the Netherlands Railways is nearing completion at the yard of Gebroeder Pot at Bolnes, Holland. This vessel has been specially designed for ferry service between Enkhuizen and Stavoren, on the Zuider Zee. She is 210′ in length, 31′ 4″ in breadth, and has a depth to the main deck of 11′ 1″. Two Kromhout six-cylinder two-cycle 500 b.h.p. surface ignition engines will give her a speed of 13 knots.

It is believed that the average cost of motorships ordered in the United Kingdom during the last six months, has been around $90.00 per deadweight ton. Some contracts have been placed at figures of about $50.00 per deadweight ton, but these are vessels involving the maximum of cargo space within the minimum limits of size. Motor vessels of more specialized construction have cost as much as $125.00 per deadweight ton.

W. Wilhelmsen, of Tonsberg, the largest private shipping enterprise in Norway, recently put into service TALISMAN, the third motorship of the seven it ordered from the Deutsche Werft, Hamburg. This firm now has a fleet of seven motorships of about 68,000 tons d.w., which will be increased to about 100,000 tons when it takes delivery of the other four ships now building for it. TIRADENTES and TITANIA are the names of the two vessels commissioned earlier.

Diesel-engined ferry boat MOTOR PRINCESS, which is making a remarkable record for punctuality

C. P. R. Automobile Ferry Motor Princess

AT the outset the new 170-ft. Diesel-engined automobile ferry, operated since May 22nd on the Bellingham-Vancouver Island Auto Ferry Circuit by the Canadian Pacific Railway B. C. Coast Steamship Service, was started on a schedule of one round trip a day between Bellingham, in the State of Washington, and Sidney, Vancouver Island, the distance between the two ports being 43 nautical miles.

This schedule has now been increased to two round trips a day, a total distance of 172 miles. There is a large motor vehicle traffic between the mainland coast cities and Victoria, on Vancouver Island, while the scenic highways of Vancouver Island, which are famous on the Coast, are attracting an increasing number of auto tourists.

This Diesel-engined ferry, plans and description of which were published in the May issue, has proved a credit to Yarrows, Ltd., of Esquimalt, B. C., her builders, and to the McIntosh & Seymour Corporation, who built her twin 600 h.p. six-cylinder Diesel engines. The boat has accommodation for 45 large automobiles and 250 passengers.

Capt. Neurotsos, marine superintendent of the C. P. R. Coast Steamship Service, states that the boat is working out very satisfactorily and that the engines run like a clock. Solutions have been found for some difficulties that were encountered at the start, this being the first experience of the company's officers with Diesel engines. On account of the engines being of the direct connected reversible type, in warming up before starting it was found necessary to tie her to the pier like a battleship,

Clocking Her Runs With Only Minute Differences Four Times a Day on 3¼ hrs. Schedule

but now they find no warming up is necessary, and she starts from cold every morning, with no preliminary turn-over. The quick action of the engines also was unfamiliar to men who had been handling steamships, with their possibilities of maneuvering at very slow engine revolutions.

Her schedule calls for a double daily service since July 3rd, 1923.

Leave Bellingham..7:00 a.m.	Arrive Sidney.....10:20 a.m.
Leave Sidney.....10:45 a.m.	Arrive Bellingham..2:00 p.m.
Leave Bellingham..2:30 p.m.	Arrive Sidney......5:50 p.m.
Leave Sidney......6:10 p.m.	Arrive Bellingham..9:30 p.m.

The following records for several average days, taken from the reports sent in to the marine superintendent, show that the boat is keeping up well to her designed 14-knot speed, the distance being 43 nautical miles. As the boat makes a head-on landing, she has to back out and turn around to get on her course. The times taken are from the start from alongside till the bell for " slow " at the other landing.

JULY 6TH

Left Bellingham... 7:01 a.m.	Slow for Sidney...10:14 a.m.
Left Sidney.......10:51 a.m.	Slow, Bellingham.. 2:01 p.m.

JULY 7TH

Left Bellingham... 7:01 a.m.	Slow, Sidney......10:13 a.m.
Left Sidney.......10:45 a.m.	Slow, Bellingham.. 1:57 p.m.
Left Bellingham... 2:35 p.m.	Slow, Sidney...... 5:43 p.m.
Left Sidney....... 6:10 p.m.	Slow, Bellingham.. 9:21 p.m.

JULY 8TH

Left Bellingham... 7:01 a.m.	Slow, Sidney......10:13 a.m.
Left Sidney... 10:46 a.m.	Slow, Bellingham.. 1:50 p.m.
Left Bellingham... 2:32 p.m.	Slow, Sidney...... 5:41 p.m.
Left Sidney....... 6:10 p.m.	Slow, Bellingham.. 9:21 p.m.

The run through the beautiful archipelago between Vancouver Island and the mainland of the State of Washington at this point is principally in protected waters, though there is one rather exposed channel just off Sidney, where there is an open sweep from the Straits of Juan de Fuca up Hero Strait, so that occasional bad weather in that quarter demands a seaworthy craft. Though the tides run with considerable strength in many of the passages, the force of the tide is pretty well equalized on this ferry run, owing to the cross-channel course.

Capt. J. W. Troupe, manager of the Canadian Pacific Railway's B. C. Coast Steamship Service, states that they have not yet tabulated all the data in connection with the operation of the MOTOR PRINCESS in such shape as to be suitable for publication, but the MOTOR PRINCESS is now traveling 172 nautical miles a day, beside maneuvering in and out of ports on a fuel consumption of practically 0.47 lbs. per s.h.p. The r.p.m. average a little over 200, and the speed ranges from 13.6 to 14.3 knots. With regard to the number of crew, he states that there is no saving in the engine room over an oil-burning steam job of the same power.

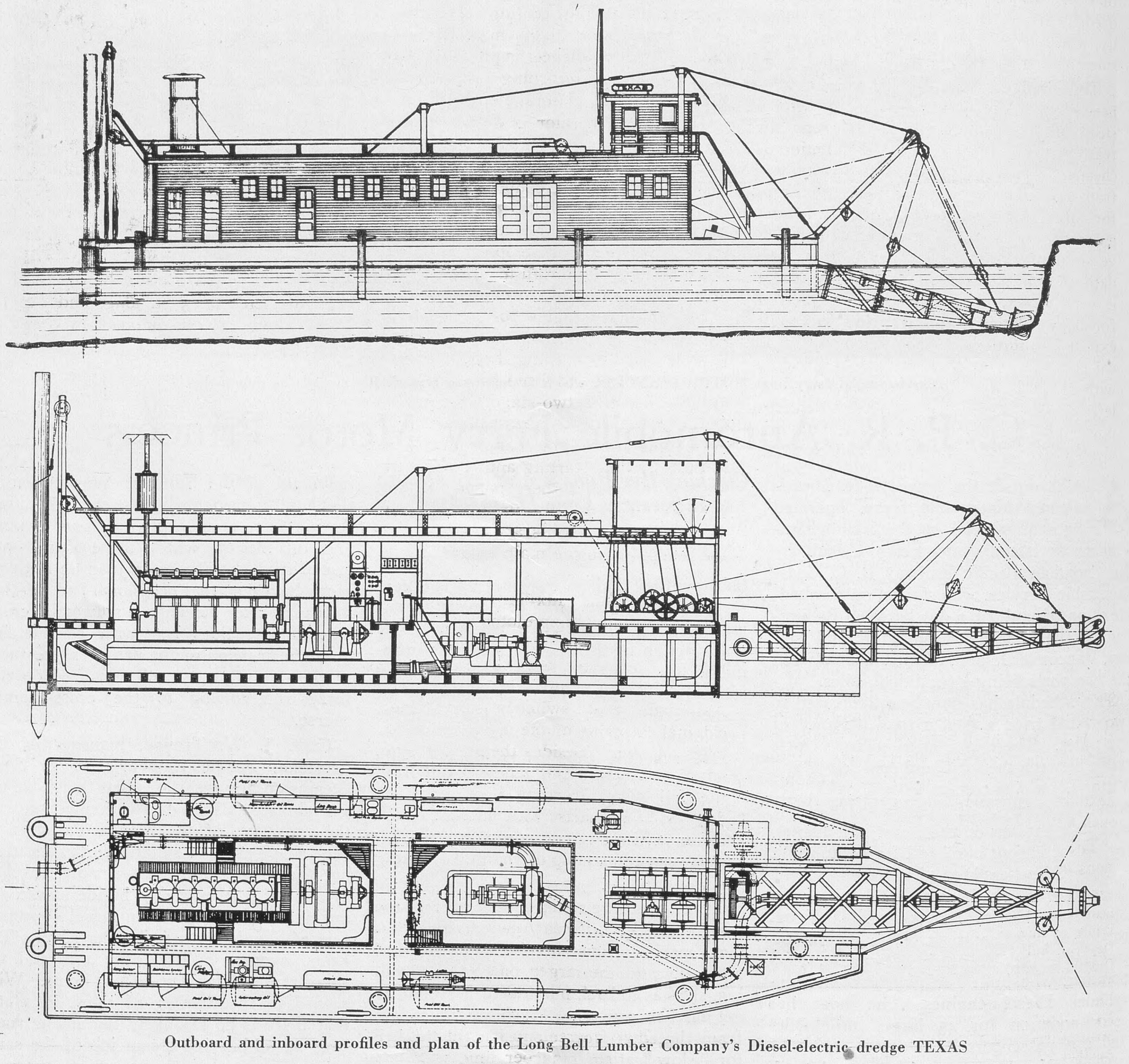
In our May issue we stated that the motor yacht LLYS HELIG was fitted with Vickers-Petters oil-engines, whereas her machinery consists of two 4-cylinder British Kromhout oil-engines of 200 b.h.p. each. Altogether the owner of this vessel has had three separate British Kromhout twin-screw sets for his various boats.

First Diesel-Electric Pipe-Line Dredge

By JAMES H. POLHEMUS*

Installation of a Pacific-Werkspoor 525 b.h.p. in an Interesting Type of Craft

WHAT will be the first Diesel-electric operated pipe-line dredge to be placed in service is being built by the Power Equipment Company of Portland, Ore., for The Long-Bell Lumber Company of Longview, Wash. The dredge has a 15-inch inside diameter suction and discharge pipe and is named the TEXAS. The type was proposed and designed by the writer to meet



Outboard and inboard profiles and plan of the Long Bell Lumber Company's Diesel-electric dredge TEXAS

the special dredging requirements of the owners.

The first and principal work for this dredge is to dig a narrow and shallow drainage ditch about five miles long skirting the foot of the hills adjacent to the Cowlitz River Valley, a property which the Long-Bell Lumber Company is developing into a large and model industrial center. The average elevation of the ground, or level of the floor of the valley, is plus ten feet; the water level in the canal will be carried at zero and the depth of cut at minus five feet. The excavated material will be deposited in adjacent low lands and blind sloughs through pipe lines varying from 500 to 4,000 feet in length.

After completing this drainage ditch the dredge will be used for general maintenance work on the Columbia River, where at times the current is very swift and the water windswept and rough. The dredging in this locality will be either from a floating pipe line or into industrial fills with a net terminal lift of 30 feet and pipe-line lengths varying in either case from 500 feet to 4,000.

The material to be dredged varies from heavy, clean, coarse sand to stiff blue clay, a varied and very difficult dredging problem, because many sunken logs and trees will be encountered in the alluvial deposits in the valley.

Cheap electric power is not available at this time to operate the dredge, but within two or three years, when its new power plant is completed, The Long-Bell Lumber Company will have a great surplus of electric power available from its saw-mill power plant. They intend to operate all their plants by electric power and desired, therefore, at a later date, when the plant is completed, to have an electric dredge for maintenance work.

The problem of supplying the dredge with fuel-oil involves considerable towing, pump-

* General Manager and Chief Engineer of the Port of Portland.

ing the oil over a thirty-foot dike from a fuel-barge on the outside to another in the canal, thus considerably increasing the fuel costs, which would be almost prohibitive if the dredge were equipped with oil-fired boilers and steam machinery.

These general conditions have been recited in more or less detail so that it may be understood that the design of the dredge has been carefully worked out to meet certain fundamental operating conditions involving an economic as well as an engineering study of the question. It was estimated that the saving in operating costs of this dredge, over a steam dredge of like capacity, would be as much as $15,000 a year, besides having many other advantages.

This dredge embodies a number of pioneer steps. Alternating current is used instead of the customary direct current, the reasons being that such an installation is cheaper, easier to operate, can be operated from outside power in case of emergency, or for any reason whatever, such as a very cheap power rate, and is adaptable for conversion into an electric dredge at a later date at a minimum expense. The dredge is very rugged and heavily built, suitable for heavy digging and working in rough, exposed conditions. The dredge is a typical contractors' dredge, simple as possible, with all frills and unnecessary refinements left off. It embodies the best Diesel-electric power-plant generating practice and the best electric dredging practice, backed by years of dredging experience.

At the time of writing the TEXAS is nearing completion and is due to go into operation during the present summer. This article is only intended to describe this most interesting dredge in a general way. Before the dredge goes into commission very complete engine and pump tests will be made to determine its efficiency on all lengths of pipe lines. Properly designed nozzles to represent various lengths of pipe lines will be used to run these tests. When these nozzle tests have been run and the dredge has been in operation for thirty days, another article will follow covering the economies, flexibility, efficiency and operating costs of such a type of dredge.

The following are the principal dimensions of the TEXAS:

TEXAS:

Length of hull	104 ft.
Width of hull	32 ft.
Depth of hull	8 ft. 6 ins.
Draft (forward and aft)	4 ft. 6 ins.
Fuel capacity	150 bbls.
Estimated fuel consumption per 24 hrs.	17 bbls.
Main Diesel engine	525 b.h.p.
Main generator 2,300 volts	450 k.v.a.
Auxiliary surface-ignition engine	16 b.h.p.
Auxiliary generator, 220 volts	9 k.v.h.
Main pump motor, 2,200 volt	350 h.p.
Hoist motor, 2,200 volt	40 h.p.
Cutter motor, 2,200 volt	50 h.p.
Two service pumps, each 220 volts	10 h.p.
Two oil-transfer pumps, each 220 volts	1 h.p.

The motors on the dredge pump-hoist and cutter are 40 degree variable-speed slip-ring motors, good for continuous overload, 33 per cent. speed reduction and 2,200 volts. The small pump and shop motors are squirrel-cage induction motors 220 volts. The current throughout is alternating three-phase 60-cycle. The generators were furnished by the General Electric Company and the motors by the Allis-Chalmers Company.

The main power-plant is a 525 b.h.p. Pacific-Werkspoor engine of six cylinders, 15-inch bore and $23\frac{5}{8}$-inch stroke, operating at 225 r.p.m. The engine is to run on ordinary 14 degrees Beaumé fuel-oil. There are two fuel-oil day tanks fitted with hot-water heating coils and acting also as settling tanks. The engine is fitted with an overboard pipe-cooling system to handle the circulating water for cooling the engine, due to the muddy water to be encountered in the canal. A Maxim silencer is provided, as well as a full set of recording pyrometers, air gauges, speed regulators, etc.

The main generator is designed to take care fully of the overload possibilities of the main Diesel engine, and is driven from it through a flexible coupling. It is rated as 450 k.v.a., 2,300 volts, 3-phase, 60-cycle. Its exciter is direct connected. Transformers are provided for stepping this current down to 220 volts for all motors, except the main pump hoist and cutter motors.

The auxiliary engine for the generating set consists of a 16 b.h.p. Skandia surface-ignition engine, burning Diesel oil of 24 degrees Beaumé and fitted for electric starting. It drives a two-stage air-compressor as well as a 9 k.v.a., 220-volt 3-phase 60-cycle generator. This compressor is used to pump up the starting and fuel injection-air bottles, should these pressures be lost for any reason. The auxiliary generating set is to furnish lights and operate any of the pumps when the main engine has to be shut down.

The main and auxiliary generators, as well as the main pump motor, are controlled from a main switch-board in the engine-room. The winch and cutter motors are controlled by the man in the lever-room. Automatic safety switches prevent the accidental throwing of the 2,300 and 220 voltages together. Besides the regular switch-board voltmeters and ammeters, there are the following recording instruments with daily 24-hour charts: watt meter, frequency meter, cylinder pyrometers, engine speed, pump vacuum, pump discharge pressure and pump speed.

The dredging pump is designed to operate with two different diametered runners, the smaller runner for the shorter pipe line lengths and the larger one for the longer lengths. The pump is driven by a 350 H.P. 2,200-volt 3-phase 60-cycle 450 r.p.m. variable speed 40 degree slip ring motor. The speed reduction is 33 per cent. and a continuous overload capacity without excessive heating is provided. The flexibility obtained through the variable speed and overload characteristics of the motor, combined with the two sizes of pump runners, allows the dredge to be operated to its fullest efficiency on all lengths of pipe lines up to 4,000 feet. The dredge pump is primed by a hydraulic ejector connected to service pumps, of which there are two, driven by 10 h.p. motors and which furnish circulating water for the dredge pump main-bearing seal, cutter-head bearings, fire service, and priming the dredge pump. Only one of these pumps is operated at a time, the other being kept in reserve. The Diesel engine has its own fuel-oil, lubricating-oil, and circulating-water pumps, which are in duplicate and made as an integral part of the engine.

The hoist is an electric-driven, five-drum, heavy-duty winch designed specially for dredging purposes. The motor is a 40 degree 40 h.p. 2,200-volt 900 r.p.m. variable-speed slip-ring type.

The ladder is about 48 feet long, built of structural steel and designed especially to dig in shallow water. The cutter shaft is six inches in diameter, the suction pipe fifteen inches inside diameter, and the cutter is of cast-steel, with removable steel blades and designed to prevent obstructions from entering the suction pipe and thereby cause loss of vacuum. The cutter is driven by a 50 h.p. 2,200-volt 3-phase 60-cycle 900 r.p.m. variable-speed 33 per cent. 40 degree slip-ring motor.

There are four fuel-tanks, 4 ft. diameter by 15 ft. long; one lubricating-oil tank, $3\frac{1}{2}$ ft. diameter by 5 ft. long, and one fresh water tank, $3\frac{1}{2}$ ft. diameter by 10 ft. long.

The hull is very heavily built of Douglas fir, having 6 inch solid gunwales. There are four longitudinal bulkheads, two of which run the full length of the dredge and are diagonally sheathed with one inch plank. There is a cross bulkhead at the aft end of the dredging well and one at the center of the dredge between the engine and pump hatches.

In order to cut a 60 ft. channel, the bow of the dredge is narrowed down. Due to the heavy weights of engines and heavy duty required of the dredge the hull has been designed with extra strength. The spuds are 24 inches in diameter and the cast-steel spud wells are particularly heavy, their fastenings more than ample and very carefully distributed to catch numerous strength members of the hull. The dredge is to cost, complete with pipe lines and attending plant, about $150,000.

To take care of increased tourist traffic a motor ferry boat has just been placed on the Anacortes-Vancouver Island run. This boat, which has been re-named MOUNT VERNON, was originally built for the Seattle Port Commission, by whom it was turned over to the Kings County Commissioners when the Port Board retired from the ferry business. At that time she was known as the ROBERT BRIDGES. It was her misfortune to have been equipped with a new type of engine, which passed like a meteor over the marine oil-engine world some years ago, leaving a streaming tale of failures behind it. The ROBERT BRIDGES was laid up for a long time, but was recently purchased by the Victoria-Anacortes Ferry Company, which tore out the old engine and replaced it by a 200 h.p. Fairbanks-Morse surface-ignition engine. The boat has a capacity of 30 automobiles and 400 passengers.

Interesting Notes and News from Everywhere

The motorship LAPONIA, belonging to the Grängesberg Ore Company, of Stockholm, was in Philadelphia recently and discharged 8,000 tons of ore.

A cut of ten cents per barrel in the price of bunker oil was made effective by the Standard Oil Company of New Jersey on July 18th. This brought the price of oil down to $1.60 per barrel, f. o. b. New York Harbor refinery.

A visitor to the Morse Dry Dock & Repair Company's Plant at Brooklyn, New York, last month was the SVEALAND, a vessel of about 1,500 d.w. tons equipped with Polar Diesel engines built in Stockholm. She underwent a general overhaul in the yards.

PACIFIC CARRIER and PACIFIC TRADER will be the names of two new Furness-Withy motorships of 11,000 tons deadweight, driven by Diesel engines, that will be placed on the service between the United Kingdom and the Pacific Coast in the early part of next year.

INJECTION SYSTEM OF SMALL PACIFIC-WERKSPOOR ENGINES

Most of the Pacific-Werkspoor Diesel engines sold recently for tug boat work have been of the airless injection type. The 100 b.h.p. three-cylinder engines for the Lillico Tug and Barge Company, of Seattle, for John Jacobson, of Galveston, and for the Daniel Contracting Company, of San Francisco, respectively, are all of this type. The latter Company's order is for the replacement of a gas engine in their tug SUDAN. A 150 b.h.p. four-cylinder engine for C. L. Ashton, of Houston, Texas, is also of the airless injection type. On the other hand the four-cylinder 200 b. h. p. engine recently installed in the tug boat GALVEZ is of the air injection type.

FOUR TUGS ORDERED BY WAR DEPT.

Under proposals received and opened at the Philadelphia office of the U. S. Corps of Engineers, the contract for four 50 ft. motor tugs has been awarded to the Spedden Shipbuilding Company, Baltimore, Md., the lowest bidder for the four tugs combined, at a total price of $112,337.00, based on the installation of Kahlenberg 100 h.p. engines. Delivery of the tugs will be accepted by the United States at the shipyard of the contractor. Two of the boats are for use at Philadelphia and two are for service on the Great Lakes. On one tug a Kitchen reversing rudder with pilot house control is to be installed. The dimensions of these boats are as follows:

Length (o.a.)	53′ 3″
Length (b.p.)	50′
Breadth (o.a.)	14′ 1½″
Draft forward, about	4′ 0″
Draft aft, about	5′ 0″
Displacement, about	41 tons

An outboard profile deck plan of this tug was published in our July issue.

World's Record of New Construction, Ships' Performances and Other Matters of Note in the Motorship Field

Wm. Cramp & Sons Ship & Engine Building Company announce that Mr. George D. Martin has been elected secretary and treasurer of the company.

LOS ALAMOS will be the new name of the motor tanker BRAMMELL POINT, which was recently purchased by the General Petroleum Company. She will be used to carry oil from California to Atlantic Ports.

SHIPPING BOARD RAISES WAGES

At the beginning of last month wages were raised by the Shipping Board for deck officers, engineer officers, stewards, cooks and radio operators. The following is a comparison between the old scale and the new, for engineer officers.

Class of Vessel	*A*	*B*	*C*	*D*	*E*
OLD SCALE					
Chief Engineer	$280	$250	$240	$230	$220
1st Assistant	175	170	165	160	155
2nd Assistant	155	150	145	140	135
3rd Assistant	135	130	130	125	120
4th Assistant	120	115	...	...	...
Junior Engineer	100	...	...	...	...
NEW SCALE					
Chief Engineer	$300	$270	$260	$250	$240
1st Asst. Engr	195	190	185	180	175
2nd Asst. Engr	175	170	165	160	155
3rd Asst. Engr	155	150	150	145	140
4th Asst. Engr	140	135	...	...	...
Junior Engineer	120	...	...	...	...

Wages of Diesel engineers run higher, ranging from about $30.00 a month extra and downward.

NEW YORK HARBOR MOTOR TUG

An excellent showing was made on trials by the EUGENIA M., a converted towboat belonging to the Moran Towing & Transportation Company, of New York City. She was formerly a Navy wood tug and measures 88′ in length, by 20′ beam and 10′ 6″ moulded depth. Her draft forward is about 5′ 6″ and she draws about 8′ 6″ aft.

When the Moran company bought three tugs from the Navy last year, the steam machinery in one of them was in such shape that it was not worth repairing. They decided to re-engine her, and took the opportunity to try out the Diesel type of motor. This is the first motor boat they have had.

EUGENIA M. has had a 320 b.h.p. 4-cylinder Trout engine installed. This operates on the 2-cycle system, with the scavenge air supplied by a double-acting pump driven off the forward end of the crankshaft and supplying air to an intermediate receiver at a pressure of 2½ pounds. This engine, which has cylinders 14¼″ diameter, and a piston stroke of 21″, develops its power at 220 r.p.m.

During the acceptance trials, which took place about the end of July, it was demonstrated that the engine could be reversed from full ahead to full astern in 8 seconds.

A total of 13,050 h.p., representing 129 engines, appears on the list of boats that have been equipped with Atlas-Imperial Diesel engines. The power varies from 55 h.p. to 350 h.p.

Having terminated its Puget Sound agency for the Williams Steamship Company, the Alaska Steamship Company is withdrawing the motorship KENNECOTT from the Williams intercoastal service and will operate it between Seattle and Alaskan ports.

Announcement is made by the Westinghouse Electric Manufacturing Company that James C. Bennett, Comptroller of the Company, has been elected a director, to succeed John R. McCune, who died a couple of months ago. Mr. Bennett is one of the oldest employes of the Westinghouse Company, having been with the firm since 1886.

GREAT LAKES AND BARGE CANAL MOTOR CARRIER OF 2,500 TONS

One of the twin screw motorships for the Minnesota-Atlantic Transport Company will soon be completed by the Great Lakes Engineering Company at its Ashtabula yard. The two Lombard-Diesel engines for this vessel are now being installed.

This boat is designed for operation on the Great Lakes and through the New York State Barge and Welland Canals, being of full Welland Canal dimensions, 258 ft. long, 42 ft. beam, and 90 ft. depth. She is being constructed to the highest class of the American Bureau of Shipping for Great Lakes and Coastwise trade, which covers trade to the West Indies, Gulf of Mexico, and Caribbean. On the Barge Canal, the deadweight capacity of the boat will be about 2,000 tons, increased to about 2,600 tons at sea.

This vessel, together with her sister ship which is also building on the Great Lakes, will have about 600 tons of refrigerator space intended for the carriage of dairy products from Minnesota and the Northwest to New York City, the former being the producing area and the latter the big market. These products will be moved from the Port of Duluth, on Lake Superior, to New York City in about eight days.

These vessels, as previously mentioned in these columns, are of the Diesel electric type. They will have all auxiliary machinery operated electrically. The living quarters will be heated by electricity and the cooking will be done from an electric range. Even the bath water will be electrically heated.

The Minnesota-Atlantic Transport Company is owned by the MacDougall Terminal Warehouse Company, of Duluth, Minnesota. A. Miller MacDougall, president of the company, is the son of the late Capt. Alexander MacDougall, the inventor of the whale-back type of Great Lakes vessel.

An Economical Harbor Tug

CAPT. J. A. CATES' 55-foot harbor tug RADIO, previously described in this publication, the first of the British Columbia tow boat fleet to be equipped with Diesel power, has been in commission since early in March, 1923, and has been keeping her single screw very busy ever since, shifting scows, towing logs, and doing other work around the port. The log towing, which occupies a good many of the harbor tugs, consists of taking logs from the booming grounds on Burrard Inlet around to mills on False Creek, or else relieving large tugs of the booms they have brought down the coast, and taking them up False Creek.

It is heavy work, the log booms being made up in sections 60 to 80 ft. wide and with a swifter stick, across the top of the logs and chained to the boom sticks at either side, at the end of every 50-ft. section. The logs of fir or cedar run from about 2½ ft. to over 6 ft. in diameter, and run 30,000 or 40,000 ft. board measure to the section. They are heavy tows, the larger tugs bringing 30 to 50 section units for the smaller tugs to handle through the bridges into False Creek.

This is the kind of work the RADIO has been plugging away at with a crew consisting of captain, engineer and deck hand. On July 9th the RADIO took a 33-section boom from the tug SEA LION in English Bay, and, making two tows of it, took it through the bridges up False Creek.

The engineer has been keeping a careful record of the fuel and lubricating oil consumption, and Capt. Cates reports that for the first 402 hours of running from the time when the RADIO was put in commission early in March till the end of May, she used up only 900 gallons of Diesel oil fuel and 25 gallons of lubricating oil. For the month of June she did 255 hours running on a consumption of 650 gallons of Diesel oil and 12 gallons of lubricating oil, the fuel costing 6 cents a gallon or a little less, and the lubricating oil about $1.20 a gallon. Thus the cost for fuel per day with the engine running on an average of 8.5 hours (which of course includes quite a lot of idling and slow speeds on harbor work) is $1.30, and the cost for lubricating oil per day 50 cents. This works out at about 15 cents per hour for fuel and 6 cents per hour for lubricating oil, which is regarded as a remarkably economical performance for a 90 h.p. engine. She first filled 1,000 gallons of 24° fuel on March 9 and did not re-fuel till June 1st. RADIO is a heavily constructed craft, with sawed frames, built of British Columbia fir. She is 55 feet o.a., 14 ft. moulded breadth, 7 ft. 6 in. moulded depth and 7 ft. 10 in. draft. Her fuel tank has a capacity of 1,600 gallons, which would give her a cruising radius of about 3,500 miles at full speed. The engine is a 90 h.p. four-cylinder four-cycle Atlas-Imperial Diesel. It is 8½ in. bore by 12 in. stroke, and the normal engine speed is 320 r.p.m. turning a three bladed propeller 52 in. diameter, 44 in. pitch with blades 17in. wide. Her trial speed was 10 knots and the normal speed is 9 knots. The main engines, without propeller and shaft, weigh 13,500 lbs., and the length of engine is 11 ft. 11¾ in. Boat and equipment cost about $25,000.

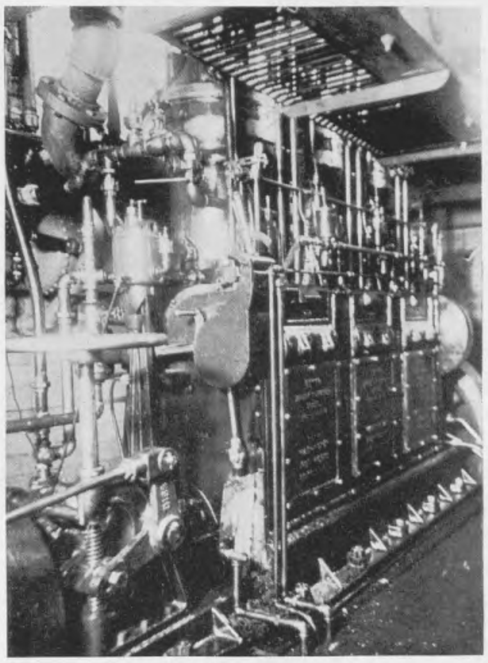
What Capt. Cates thinks of the RADIO's performance is best summed up in the order he has given the Westminster Marine Railway of New Westminster, B. C., for another tug of similar construction, 60 ft. over all, by 16 ft. beam, to be equipped with a 125 h.p. three-cylinder Atlas-Imperial Diesel engine, ordered through Ferrier & Lucas who installed the first engine. This tug also will be equipped with a centrifugal pump connected to the main engine, for fire-fighting or pumping out scows, more powerful than the one on the RADIO, which has a capacity of about 800 gals. per minute at 55 lbs. pressure and can throw a stream 125 feet from a 1¼ in. nozzle.

CONVERTED TUG ELMORE

One of the oldest towing companies on the Pacific Coast is the American Tug Boat Company, of Everett, Washington, which now owns and operates about 24 boats, one of which is the ELMORE, two of which are equipped with surface-ignition engines, and the rest of which have either steam or gasoline power.

Recently this company took its old steam tug R. P. ELMORE, which had been in use for many years in Puget Sound and Alaska waters and decided to convert her to Diesel power. She was rebuilt at the tug company's own repair plant at Everett, Washington. Measuring 76 ft. overall by 17 ft. beam and drawing 9 ft. of water she was formerly equipped with a 150 i.h.p. fore and aft compound condensing steam engine and Scotch boiler.

This machinery has been replaced by a 110 b.h.p. Washington-Estep Diesel engine, which is a three-cylinder, four-cycle machine, with 10¾ in. by 16 in. cylinders, turning at 280 r.p.m. for full power. In this design the fuel is injected directly into the combustion chamber without high pressure air. As shown in the illustration on this page the engine affords excellent accessibility to all parts.



110 b.h.p. Diesel engine in tug ELMORE

During the six months of daily operation that have passed since the converted boat was placed in service no delay or trouble of any kind has been experienced, no repairs have been necessary, nor have any bearings yet required adjustment. This is a splendid showing because the vessel in her regular work, which is long log towing on Puget Sound, operates 24 hours a day, having a complete double crew aboard. The fuel consumption under service conditions never exceeds 5 gallons of 24° California fuel oil per hour, costing about 4 cents per gallon on Puget Sound. Lubricating oil consumption measures about 2 gallons in a 24-hour run.

American Tug Boat Co.'s tug ELMORE at Everett, Washington, tow ing 14 sections of Douglas fir. This boat was formerly a steam tug

A twin screw Diesel-engined tank ship CANEPA was recently launched by the Cantieri Officini Savoia, near Genoa. She is a vessel of about 7,500 tons.

A total of 122 ships of over 1,000,000 tons d.w.c. and engined with 372,000 i.h.p. is shown on the June, 1923, list of Diesel motorships engined by Burmeister & Wain or equipped with Diesel engines of their design.

Two ships of 8,400 tons d.w. carrying capacity have been ordered from Swan, Hunter & Wigham Richardson, for undisclosed owners. These ships are to have Neptune Diesel engines built at the Swan Hunter Works.

Both two-cycle and four-cycle Diesel engines are being installed in twelve motor tankers now under construction at Fried. Krupp's Shipyard, Kiel-Gaarden, Germany, three of which are to the order of the German American Petroleum Company.

In the vessel laid down in their own yard at Kobe, Japan, the Mitsui firm has decided to install a Burmeister & Wain long-stroke engine developing 2,000 b.h.p. at 95 r.p.m. The ship will measure 375 ft. by 50 ft. by 30 ft., and will have a loaded draft of 25 ft. 6 in.

E. W. Petters, the newly elected president of the British Engineers Association, is a well known figure on the other side. He is Chairman of Petters, Ltd., and Managing Director of Vickers-Petters, builders of surface ignition engines, for marine and stationary work.

A motor vessel of 8,000 tons has been ordered by James Chambers & Co., of Liverpool, and will be built by the Caledon Shipbuilding & Engineering Co., Dundee.

For passenger and cargo service on the lower river Plate a small motor vessel has been built in Germany, measuring 85 ft. by 23 ft. by 5 ft., driven by a 250 h.p. Koerting type of Diesel engine.

The two 14,000 ton tankers PHOEBUS and POTHMITUS, building for the Standard Oil Company at the Howaldtswerke, Kiel, are almost ready. They are twin screw vessels with 3,000 b.h.p. Diesel machinery.

A NEW DEVELOPMENT

In the new 4,000 ton motorship MARGRETIAN, launched recently at Bristol, England, for account of Welsh owners, there are to be fitted two Beardmore oil engines of a new design, intermediate between the ordinary surface ignition engine and the Diesel type. Each of these engines will develop 600 b.h.p. from six cylinders of 17" diameter and 14" stroke.

The design covers an engine of the two-cycle type with crank case compression and port scavenging. The compression is about 300 lbs. per square inch. Fuel is injected by a separate pump for each cylinder near the top dead center, the fuel being sprayed into the cylinder through an automatic spring-loaded needle-valve atomizer. For starting from cold, use is made of electric plugs in each cylinder. Forced lubrication under a pressure of six to ten lbs. per sq. in., is employed for the main bearings and reciprocating parts. The fuel consumption is estimated to be between 10% and 15% higher than the Diesel engines.

FRENCH GOVERNMENT OUT OF SHIPPING

When the accounts of the French Government's transactions in merchant shipping are finally closed, as they are expected to be by the end of July they will show a loss of about $135,000,000. This seems to be a reasonably small deficit for a venture that involved at one time about 1,000,000 tons of shipping. The experience of France in the shipping business differed from that of most other countries in which Government ownership was tried, by reason of the fact that it was not until 1918 that the French Government voted its first appropriation for the purchase of ships.

A number of vessels were ordered in this country. During the war, the French shipyards were almost entirely occupied in making munitions and in repairing damaged vessels by the Allies. It did not take long, however, for the French people to realize that the Government operation of vessels would impose a very severe burden upon them, and in the summer of 1921, the French Legislature instructed the Government to get out quickly.

The only conditions of the law were that the sales should be for the interest of the National Treasury, that the contract should be approved by the Chamber of Deputies, that the purchaser could not resell without Government approval, and that he must pay the Government one-half the profit, if any, from such a sale.

In exactly two years the French Government has disposed of about 1,050,000 deadweight tons. The vessels realized only about ten per cent. of their cost, but the loss on the sale of its vessels was considered wiser than to continue supporting the burden of the exceedingly heavy operating expenses.

Fiat Buys Engine Works of Ansaldo San Giorgio

AN authoritative statement has been made to us by the Fiat company of Turin, Italy, covering their recent purchase of the Turin plant of the Ansaldo San Giorgio company. The construction of Diesel engines will be continued there under the name of "Fiat-Stabilimento Grandi Motori." This change of ownership will put the business on a sound basis, the Fiat company being one of the strongest industrial concerns in Italy, and having safely weathered the period of financial stress which affected that country so acutely after the close of the war.

The Fiat concern was founded only about twenty years ago, and we believe it is literally true that it commenced business with the assembly of about twenty automobiles in its first year of business, in a small building in one of the back streets of Turin. It developed with a rapidity that is amazingly rare in Europe and would have been notable even in this country. The business was favored from the start by the unusual financial, executive and technical ability of the directors. Within a few short years the Fiat automobiles were gathering the biggest prizes in the motor racing world.

The demand that arose for those machines required continual additions to the plant. In a short time the company began to enter other fields of industrial activity, in which the manufacturing processes required a high degree of mechanical precision. In 1910 it had invaded the Diesel engine field, and was as successful in that line from the start, as it had consistently been in all its other work. The company was already manufacturing small arms before the outbreak of the World War, and by the time Italy joined the Allies in 1915, the Fiat company was engaged in a tremendous program of production.

The plant extensions and financing necessary for that work were of the same nature that the Fiat company had been dealing with from the beginning of its career, and that experience proved no doubt of incalculable benefit in saving the firm from over-expansion and over-extension of its resources.

Diesel engine construction was begun under the name of Fiat San Giorgio in a new plant which was specially designed for the work and admirably adapted to it. Engines were built only for submarines, and in 1914 we remember they had engines on order for the German Government, but we do not recall whether they were ever delivered.

In 1917 these Diesel engine works were sold to the Ansaldo interests, and the business was conducted under the name of Ansaldo San Giorgio. It is from that company the Fiat people recently bought back the plant.

It is the intention of the new owners to continue the program of the former board. The management and technical staff remains unaltered, so that there will be no interference with the work. This means that the two-cycle design which has been so successfully developed at this plant in the past, will be retained for both marine and stationary work.

The success of the Fiat San Giorgio in the field of the submarine engine and in the construction of the CEARA, submarine depot ship of the Brazilian Government, which, we believe, is still the most powerful two-cycle engined motorship afloat, was continued by the Ansaldo management in the construction of slow speed crosshead engines for merchant ships. At various times we have described in these columns, the motor vessels, ASALDO I, II, III, the VEJO and the ADRIANA. This is the side of the business which is going to be pushed.

DIESEL TUG "SEA WAVE" RUNS TRIALS

Young & Gore Towboat Co.'s 85-ft. Diesel tug SEA WAVE, built by the Vancouver Shipyards, Ltd., from designs by T. Halliday, and equipped with a Pacific Werkspoor Diesel of 200 b.h.p., ran a very satisfactory trial on July 16th. A large party of men interested in ships and shipping were guests of the owners, who were heartily congratulated on the performance of their handsome craft. SEA WAVE was tried out over the measured nautical mile, first at 220 r.p.m., at which she made a speed of 8.29 knots. Then she was speeded up, and at 250 r.p.m made 9.1 knots and at 270 r.p:m. 9.5 knots. Her normal engine speed is about 225 r.p.m. These trials were run with a towing propeller, four-bladed, 78 in. diameter, 45 in. pitch and 15 sq. ft. area. Her tanks were also full, there being 5,000 gallons of Diesel oil, and 1,000 gallons of water aboard. In this trim the SEA WAVE was drawing $8\frac{1}{2}$ ft. forward and $10\frac{1}{2}$ ft. aft, with a displacement of 150 tons.

SEA WAVE, a Diesel-engined tug

This tug is very completely equipped throughout, having electric towing winch and electric windlass, power launch and other mechanical conveniences. She is very comfortably fitted up below, the crew's quarters, with the exception of the captain's cabin, galley and mess room being located under the raised deck forward. There are cabins for the engineers and mate, and a forecastle, all opening on a social hall which has two large Pullman type berths on each side, the uppers of which drop down to form backs for a settee in the daytime. The four-cylinder four-cycle Pacific-Werkspoor Diesel engine, installed in such a solidly built hull, ran quietly and smoothly with comparatively little vibration.

The Hudson Bay Company's auxiliary schooner LADY KINDERSLEY sailed from Burrard Inlet, B. C., about a month ago for Mackenzie River and points on the Arctic Ocean as far east as Coronation Gulf. She may remain in the Arctic throughout the winter.

Ten Thousand Mile Trip of Diesel Tug

FIFTY-TWO days from Holland to British Columbia with only two stops for fuel is the report of Captain G. F. Main who brought out the 87 ft. Diesel engined tug LUCIENNE, recently purchased by Clarence Wallace, of the Wallace Shipyards, Ltd., North Vancouver, B. C.

LUCIENNE left Rotterdam on May 20th with fuel tanks full and made for the Canary Islands, arriving at Las Palmas May 30th. The only fuel available there was ordinary boiler oil; so, filling up with it, LUCIENNE sailed on June 2nd. The next port of call was Colon, where she arrived on June 20th, and proceeded through the Panama Canal the same day to Balboa where more boiler oil, of the Mexican crude variety, was all that was to be obtained, costing $1.20 a bbl. Sailing from Balboa on June 22nd, she made a non-stop run of 4,100 miles to Victoria, B. C., and anchored in Royal Roads because a pilot was not immediately available.

On account of having nothing but boiler oil on board, the engine "gummed up with the asphalt" as soon as it got cold, Capt. Main explained, and, after laying at Victoria several days, a tug had to take them in tow. The rush of water helped to turn the engine over, and soon it was firing again, the LUCIENNE coming on then to Vancouver with her own power and no further trouble. Captain Main states that with an extra feed tank of higher grade fuel to start and stop on, they would have had no trouble at all, because the engine ran all right on the low grade fuel once it got started.

A speed of $9\frac{1}{2}$ knots was maintained on the trip, and the captain expressed himself as very much pleased with the little boat's performance, the weather met on the voyage being the usual assortment of good and bad. The daily consumption of fuel was $1\frac{1}{3}$ tons.

LUCIENNE was built at Rotterdam by N. V. van Der Kuij and van Der Rees, being finished in 1920. She is classed 100 A1 at Lloyds. Her dimensions are: l.o.a., 87 ft.; l.b.p., 80 ft. 5 ins.; moulded breadth, 19 ft. 8 ins.; moulded depth, 11 ft.; loaded draft, 10 ft. Her fuel tank capacity is 34 tons, and fresh water, $13\frac{1}{2}$ tons. Her power plant is a 420 b.h.p. four-cylinder reversible Sulzer two-cycle Diesel, turning at 210 r.p.m. Her trial speed was $11\frac{3}{4}$ knots and the ordinary cruising speed is $9\frac{1}{2}$ knots. The cylinders are $13\frac{3}{8}$ in. bore and $21\frac{1}{4}$ in. stroke. An auxiliary surface-ignition engine runs the air compressor and a small generator for electric lighting. Clarence Wallace states his intention to install a more powerful auxiliary set to take care of an electric capstan and electric towing winch that will fit her for general towing work on the British Columbia coast. She is the most powerful of the British Columbia oil-engined towboat fleet now on the coast, though that fleet is growing rapidly, the LUCIENNE being the fourth Diesel towboat, the first having gone into commission in March, 1923. There is a still larger fleet of tugs with surface ignition engines ranging from 30 to 350 b.h.p.

In spite of keen competition with steam- and gas-engined tugs, tow boat operators at Vancouver who have taken up the oil engine are finding this power so satisfactory that they are ordering more of these engines and building bigger boats. The Prospect Shipping & Towing Co., which last year installed a 75 h.p. Kahlenberg oil engine in the 60-ft. tow boat PROSPECT PARK, have now placed an order through the J. W. Thompson Machinery Co. for a 75 h. p. three-cylinder Wolverine oil-engine to replace a distillate burning engine in their 42 ft. tug PROSPECT POINT.

Since the merger of the Kroeschell Bros. Co. and the Kroeschell Bros. Ice Machine Co., both of Chicago, Ill., and the Brunswick Refrigerating Co., of New Brunswick, New Jersey, the combined organization, operated under the name of Brunswick-Kroeschell Company, has been so successful in getting new business that it is now forced to expand its factory facilities. New brick and concrete buildings are being erected at a cost of approximately $500,000 upon the company's property at Diversey Avenue and the Chicago, Milwaukee & St. Paul right of way in Chicago—this sum covering also the necessary equipment. Net sales for 1922 were more than $2,000,000 and the present assets of the company are over $3,500,000.

AUXILIARY YACHT CROSSES ATLANTIC IN 7 DAYS

Edward F. Hutton's new auxiliary schooner yacht, HUSSAR, made New London, Conn., on July 17th on the nineteenth day out from Copenhagen, Denmark, where she was completed late in June. This beautiful boat, designed by Cox & Stevens and built by Burmeister & Wain, measures 196 ft. 7 in. on deck, 164 ft. on the water line, and has a moulded breadth of 33 ft. and moulded depth of 14 ft. She is a three master. Her engine, a 600 b.h.p. Burmeister & Wain Diesel, is of the reversible type, but a reversible propeller is also fitted in order to enable the blades to be trimmed fore and aft for sailing. On the Atlantic voyage the HUSSAR met westerly winds and, what were for her, heavy seas all the way. She could only spread her canvas for 29 hours during the whole passage. Under these conditions her run from Copenhagen Sound under engine power must be considered pretty fast. After touching at New London, Conn., she proceeded to Glen Cove, L. I., for her owner's inspection and went into drydock on July 21st, preliminary to going into commission for her owner, who, after a cruise of four or five days in her, will keep her in New York waters for the summer.

German Oil-Engines for Merchant Ships

By Professor Walter Mentz, Technische Hochschule, Danzig

(*Continued from page 506, July issue*)

It will have been noticed in the table given in the first instalment of this article that practically all the engines are of the four-cycle type, only two being in the two-cycle class, whereas the engines given in a similar table published by the author in 1913 were very nearly all of the latter type.

GEBRÜDER SULZER A.-G., LUDWIGSHAFEN-AM-RHEIN

It is generally admitted that the two-cycle engine will be used where there is question of greater power than is now generally being considered. Various big firms, building the four-cycle type only, are therefore continuing their experiments with the two-cycle engines as before.

The two-cycle type is held by its proponents to offer a great advantage for marine purposes because it can give about twice as much power as the four-cycle type for the same cylinder dimensions, same number of revolutions and the same mean pressure. The four-cycle type has the advantage, however, that the products of combustion can more easily be removed and the fresh air introduced, because two full strokes are utilized for that purpose.

It was not possible during the war, because of the great pressure of other work, to solve all the difficulties connected with the two-cycle design. The less difficult and better known four-cycle engine was therefore preferred. It was particularly suited for submarines because of the high number of revolutions it permitted. This explains why the four-stroke is chiefly being built in Germany after the war, whilst the two-stroke is more popular in some other countries. In Great Britain, for instance, two-thirds of the works that are building Diesel engines have decided in favor of the two-cycle design.

The leading firm for two-cycle engines in Germany is Gebr. Sulzer, the Swiss company, which has a branch works in that country and which at an early stage had decided in favor of this type of motor for marine purposes. Sulzer's have built two-cycle engines since 1905, and have developed this type without interruption since. This firm claims, by means of a number of improvements, to have been able to reach the same fuel-consumption and the same reliability as the four-cycle engines have.

The most important of these improvements is the Sulzer scavenging system, with main and auxiliary scavenge ports. The use of scavenge valves in the cylinder cover are avoided. It is stated to have been proved by comprehensive tests on both systems of scavenging that the removal of the burnt gases by means of scavenge valves is not as good as with these ports.

Scavenging by means of valves in the cylinder cover has theoretical advantages over port scavenging, especially at high speeds. Whereas scavenging air entering through ports must travel nearly twice the length of the stroke in the short time available and also make a number of sharp changes of direction, it is only necessary for scavenging air that enters through valves in the head to travel the distance from cylinder cover to the exhaust ports, i.e., it has only to travel the length of the stroke once—it does not have to alter its direction of flow, except for a short path round the valve, and is generally forced to clean the cylinder.

Experience has shown, however, that cylinder covers containing scavenge valves have a tendency to crack at the high temperatures present in the two-cycle engine. The cross sectional area for the scavenge air is about the same with valves as with plain ports, but a greater cross section can be obtained when auxiliary ports are used together with the main ports. A smaller scavenging pressure and therefore less pumping work is then required. The auxiliary scavenge ports are arranged opposite the exhaust ports, and do not come into contact with very high temperatures, so no danger exists of the bridges buckling.

It is possible for shipowners to get a lower number of revolutions in a two-cycle engine than is economically possible in the four-cycle, on account of the saving in space and weight, but the two-cycle type can be run at the same number of revolutions as the four-stroke on merchant ships in spite of the higher average temperature, experience having shown that dependability of operation is influenced more by the design of the parts forming the combustion space than on the average temperature. A speed of 130 revolutions per minute has, for instance, been chosen for the machinery aggregating 14,000 h.p. which Sulzer's have on order for a passenger ship under construction at the Fairfield Shipbuilding Co., Glasgow. Low revolutions are considered advantageous for the shipowner because of greater efficiency of the propeller and smaller wear and tear of the engine. The engine becomes somewhat bigger and heavier per b.h.p., but the two-cycle type provides nevertheless a saving in weight and space as compared with the four-cycle at somewhat higher revolutions, which is well shown in a specific example given further on. These statements of course represent the Sulzer view. Both the two-cycle engines given in the table at the beginning of this article turn at 80 to 85 revolutions, as was required by the

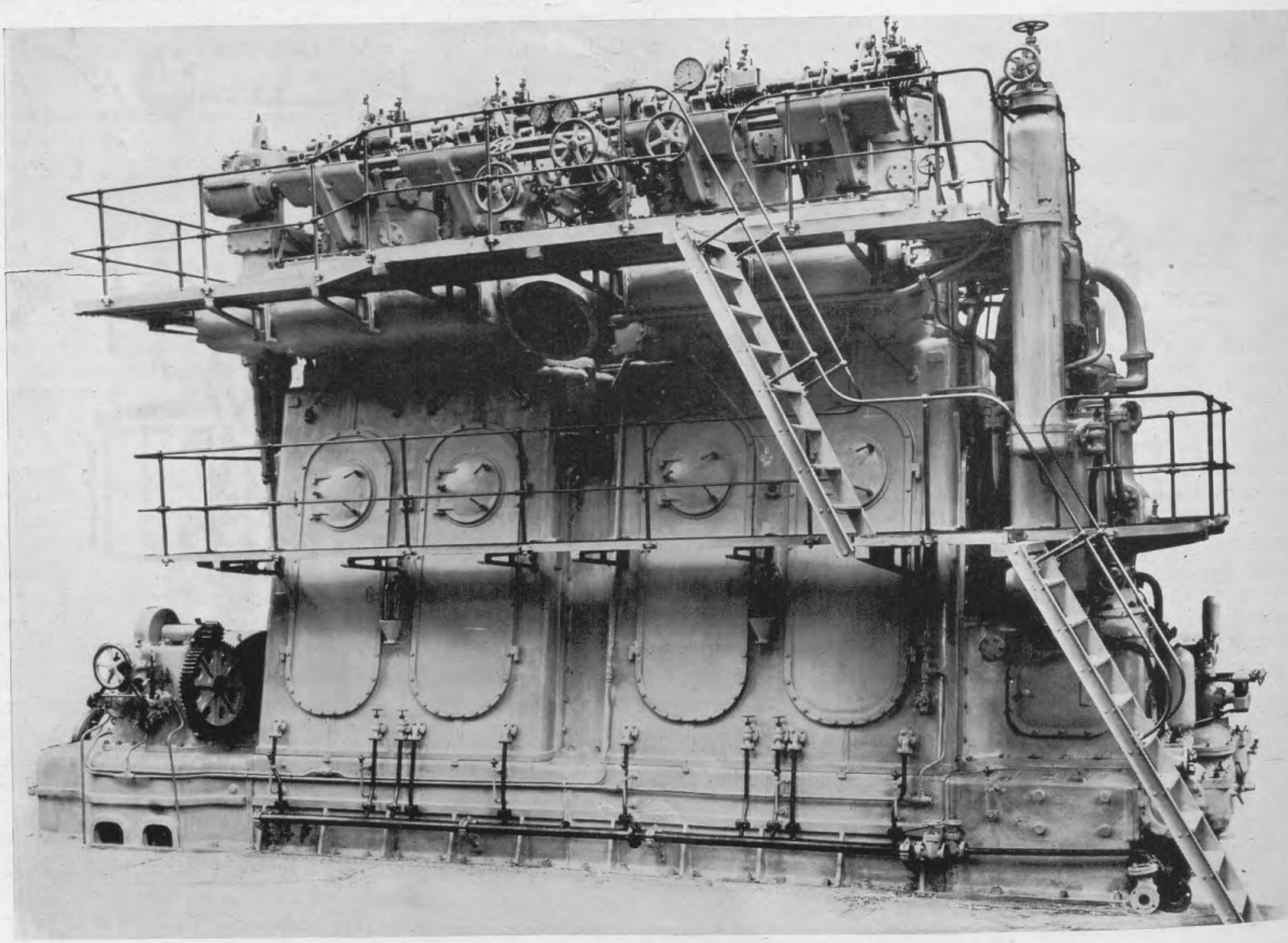


Fig. 29.—Sulzer engine from the maneuvering side, showing the control platform on the upper grating

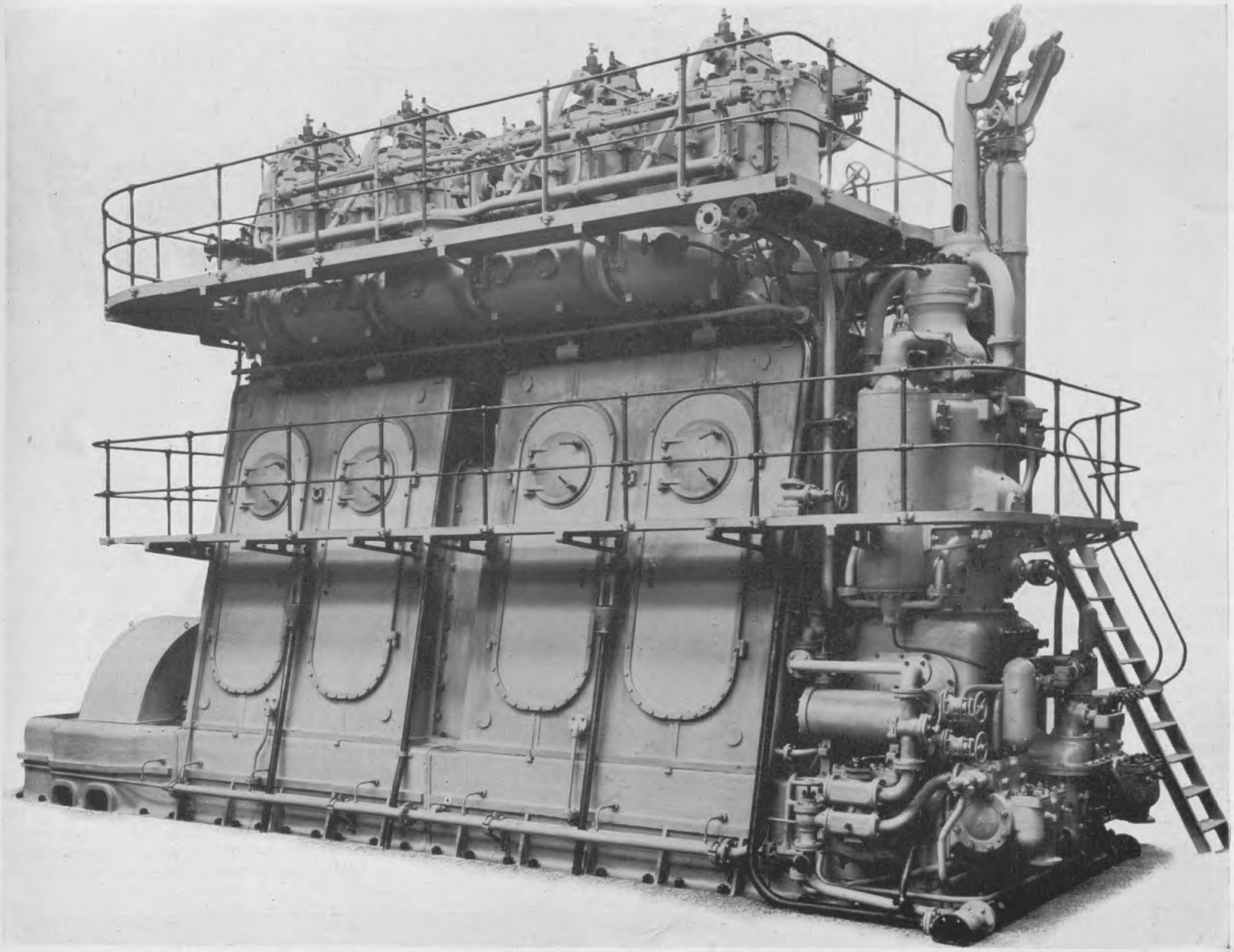


Fig. 29A.—Sulzer engine from the exhaust side, showing arrangement of air compressor and pumps at the forward end

shipowner and which hardly differs from the revolutions of marine steam engines of the same power.

In spite of the two-cycle engine of 1,600 h.p., selected for comparison, having a speed of 85 revolutions per minute, or 15% less than the M.A.N. engine of the same power at 100 revolutions per minute, it has only four cylinders of 26.77 in. diameter and 43.31 in. stroke, with only a very small increase in the mean effective pressure, as compared with six cylinders of the four-cycle engine with a diameter of 27.56 in. and a stroke of 47.25 in. Only half the piston displacement volume is now necessary with the two-cycle type as compared with earlier designs.

Four cylinders only will ensure starting a two-cycle engine, whereas six are required by the four-cycle type. Only for very large powers are six cylinders used in the two-cycle design, and the cranks are then spaced 60° apart.

It is of course impossible to expect the same running conditions and methods of operation in both types of engine. A simple comparison cannot therefore be made between them. The two-cycle type must have different attention and maintenance. Whether the construction and running difficulties of the two-cycle can be overcome by means of simple devices and whether there are advantages which neutralize the disadvantages, will now be discussed for the Sulzer-engine.

Two views, fig. 29 and 29a, show the engine from the manoeuvring and exhaust sides respectively, while fig. 30 is a cross-section through the engine. It is comparatively narrow, but nevertheless possesses enough stability. This narrowness is obtained in the lower half of the engine by using A-frames of double T-section and in the upper part of the engine by using a crosshead with four slide-bars, as in European

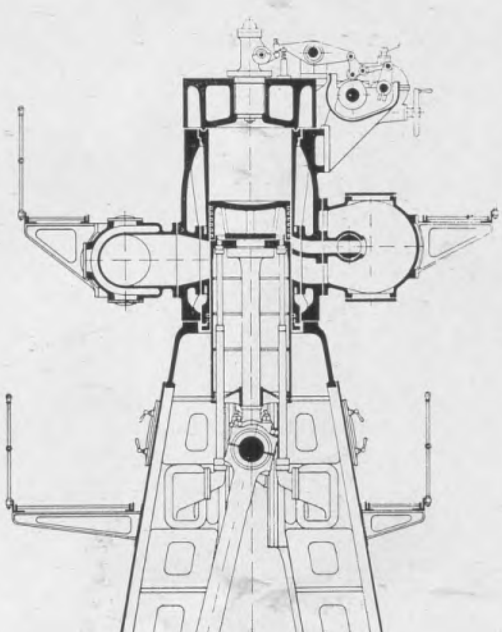


Fig. 30.—Cross-section of Sulzer engine

side-wheeler engines (figs. 31 and 32). This type of crosshead is very suitable for oil engines and removes the necessity of providing a guide between the A-frames to transmit the guide pressures to the frames themselves. The tie-bars in the frames formerly used by Sulzer's to take up the cylinder head pressures are no longer employed. In fig. 33, which shows the bedplate for a six-cylinder engine, the lightness and narrowness of the frame-construction can be clearly seen.

The peculiar scavenging will first be explained with the help of fig. 30. This takes place in the Sulzer-engine, as is well known, by means of a row of main scavenge ports, with a row of auxiliary scavenge ports higher up, controlled by an auxiliary scavenge valve. In the early designs this valve was a double-beat drop-valve, but it has now been improved into a sort of Corliss valve driven by a vertical shaft turning at half engine speed (fig. 34). The rotary valve has the advantage over the other type that it provides a better path for the air, is easy to lubricate by means of forced lubrication because it has a small angular velocity and is well cooled by the scavenging air. These valves rotate, instead of oscillating as in steam engines, and being free from variations in speed are easy to drive. The scavenge valves, which formerly were reversed by Stephenson link-motion, are now reversed in a still simpler manner by dog-clutches, which have a determined amount of back-lash suitable for the operation in both directions. Sulzer's have retained the helical gear, because the only valves to be driven from the camshaft are the fuel injection valves and the rotary valves which are well lubricated and have plenty of play and therefore only little friction.

Scavenging takes place as follows: The descending piston first opens the auxiliary ports.

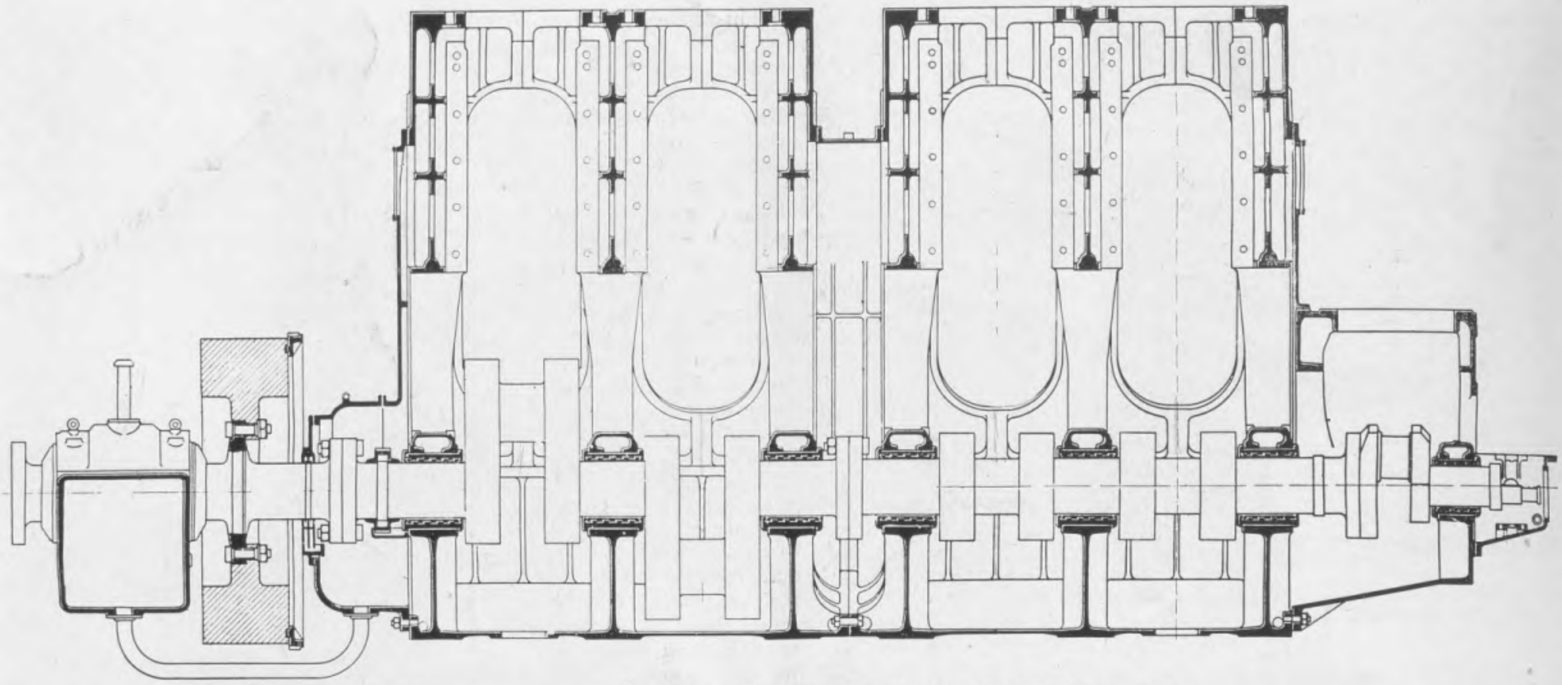


Fig. 31.—Arrangement of bed plate and framing in the large Sulzer marine design

The burnt gases expand until they meet the rotary valve, which of course is shut because the gases would otherwise enter the scavenge air piping. The piston descends further and uncovers the exhaust ports, which are seen on the left of fig. 30. The exhaust pressure is thereby reduced to less than that of the scavenging air. The lower row of scavenge ports, which are always open to the scavenge air piping is thereupon uncovered. The auxiliary ports are opened about the same time by the rotary valve. These ports point upwards and the air passing through them therefore sweeps out the upper part of the cylinder, while the lower row of ports, which point more horizontally, supply air to clean out the burnt gases from the lower part of the cylinder.

When the piston ascends it first closes the main scavenge ports, then the exhaust ports and lastly the auxiliary ports. The scavenging air having a pressure above that of the atmosphere can enter through the auxiliary ports after the exhaust ports are closed, and in this way the so-called "super-charging" can be effected.

Scavenging air can either be delivered from scavenge pumps arranged on the engine itself or from separate electrically-driven blowers which were first introduced by Sulzer's (figs. 35 and 36). The latter are smaller and lighter than other scavenge pumps because of their high speed, and operate in a simpler manner because they have no valves. They are particularly suited for cargo ships, because the Diesel engines necessary for driving the dynamos for the electric winches when loading and unloading can then, at any rate, in part, be used at sea for delivering power to the blowers. They take over the scavenging work, and the whole power of the main engines can be used for propelling the ship. Two main criticisms have been made against the two-cycle engine: 1, the crosshead pins are loaded in one direction only and therefore de-

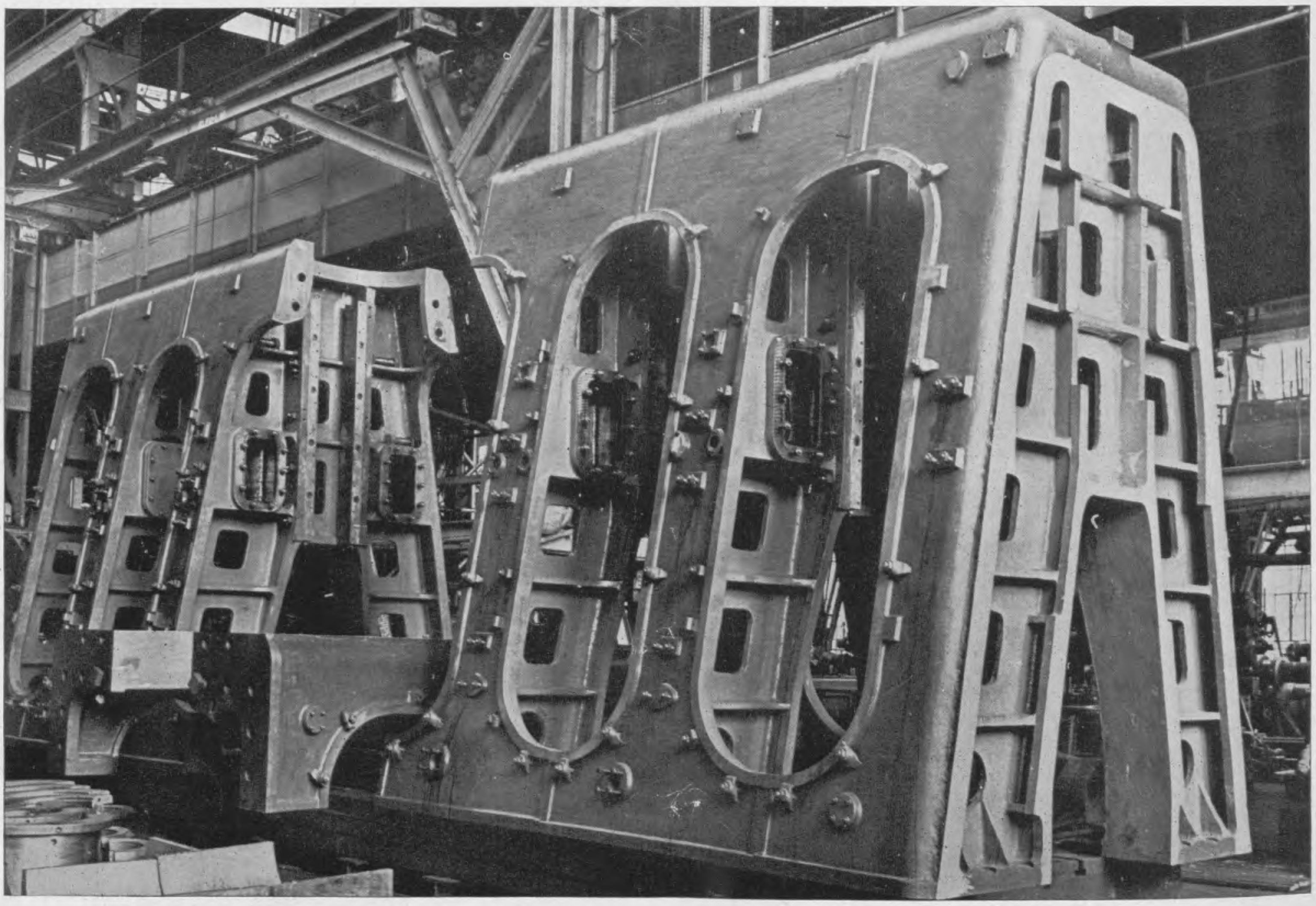


Fig. 32.—Sections of Sulzer framing, showing clearly the supports for the cross-head guides

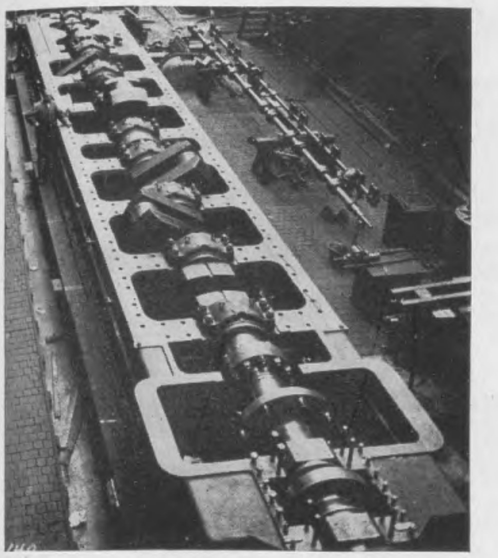


Fig. 33.—Bed plate of the Sulzer engine with shaft in position

mand lubrication under high pressure, and, 2, the stresses due to heat in the parts forming the combustion space are greater than in the four-cycle engine.

So much importance has often been attached to these disadvantages that the two-cycle type is frequently said not to possess the reliability of operation necessary at sea. These criticisms are in reality without foundation in the Sulzer engine, because of the sound practical construction of the various parts.

The oil pressure used for the main bearings would be ample for the crosshead pins if the dimensions of the latter were made big enough. Instead, a small oil pump driven by the engine itself is provided for the forced lubrication of the crosshead pins at any desired pressure between 75 and 275 lbs. per sq. in., and smaller crosshead pins are used in order to obtain smaller moving masses. (Similar lubrication is employed on the two-cycle engines installed by the Germaniawerft in the motorship ZOPPOT.) This pump is so dimensioned that it is big enough for two engines in case of necessity. The main lubricating pump, in like manner, can also take care of the crosshead lubrication of both engines after its pressure has been increased.

Thus the proper means for lubricating the crosshead pins are provided, and it is the engineers' duty to see that they are used. The engineers have of course other problems in two-cycle engines than in the four-cycle type. For instance, on the one hand the piston rings of the two-cycle engine demand more attention because of the scavenge and exhaust ports than they need in the four-cycle engine, but on the other hand the maintenance of the exhaust valves does not enter into two-cycle operation.

Lubrication of the crankshaft in the Sulzer engine is arranged with oil taken from an elevated tank under a pressure of 2.8 lbs. per sq. in. The oil enters the main bearings from underneath, as seen in fig. 37, but also fills the hollow bearing caps by means of openings in the top step, so that a kind of reservoir for the oil is at hand.

The highest temperature is no higher in the two-cycle than in the four-cycle engine. Why the former has an average temperature in the cylinder of 1020°F. as compared with about 750°F. in the four-stroke is explained by the greater frequency of the power strokes, a thing which of course cannot be altered. The dangers due to this high temperature are, however, avoided by the good design of the parts surrounding the combustion space. Even an enthusiastic adherent of the four-cycle must, in the author's opinion, admit, after he has seen the engine and drawings of this design, that the two-cycle engine has the right to exist and has under certain circumstances even advantages over the four-cycle.

The cylinder head consists only of an inner cylindrical ring for the single valve cage, an outer ring and the upper and lower walls (see fig. 38). The outer ring, which contains the cylinder head bolts without sleeves, is not water cooled and is not directly connected with the bottom of the cover, so that it does not hinder the expansion due to heat as is the case in the usual practice. The lower wall of the cylinder head, through which the heat passes, is comparatively thin; the upper one, which has to take tensile stresses, is made thicker. A more simple and practical design of cylinder head would be difficult to find, and this explains why these heads can easily stand even higher temperatures and why engines with such heads have been running

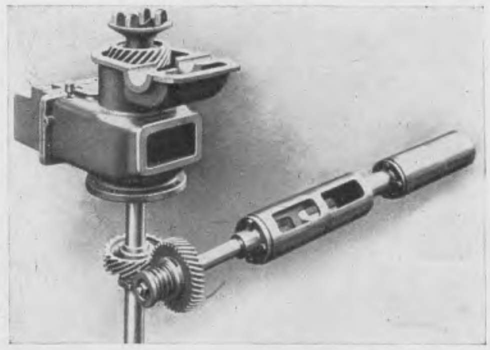


Fig. 34.—Drive of the Sulzer rotary valve

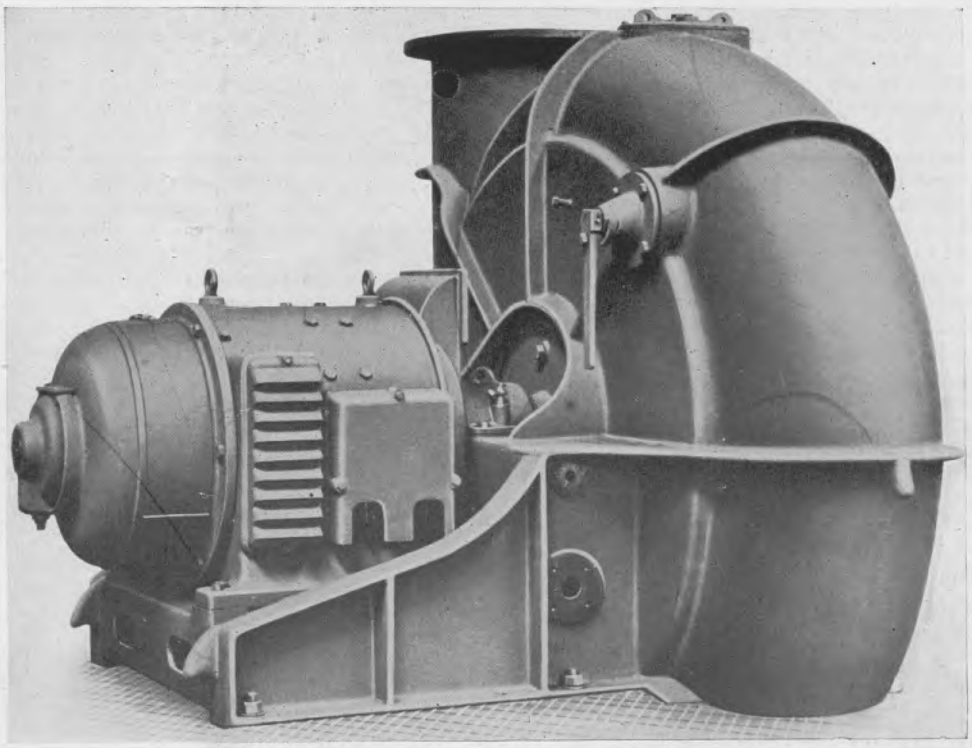


Fig. 35.—Electrically driven rotary blower for Sulzer engine

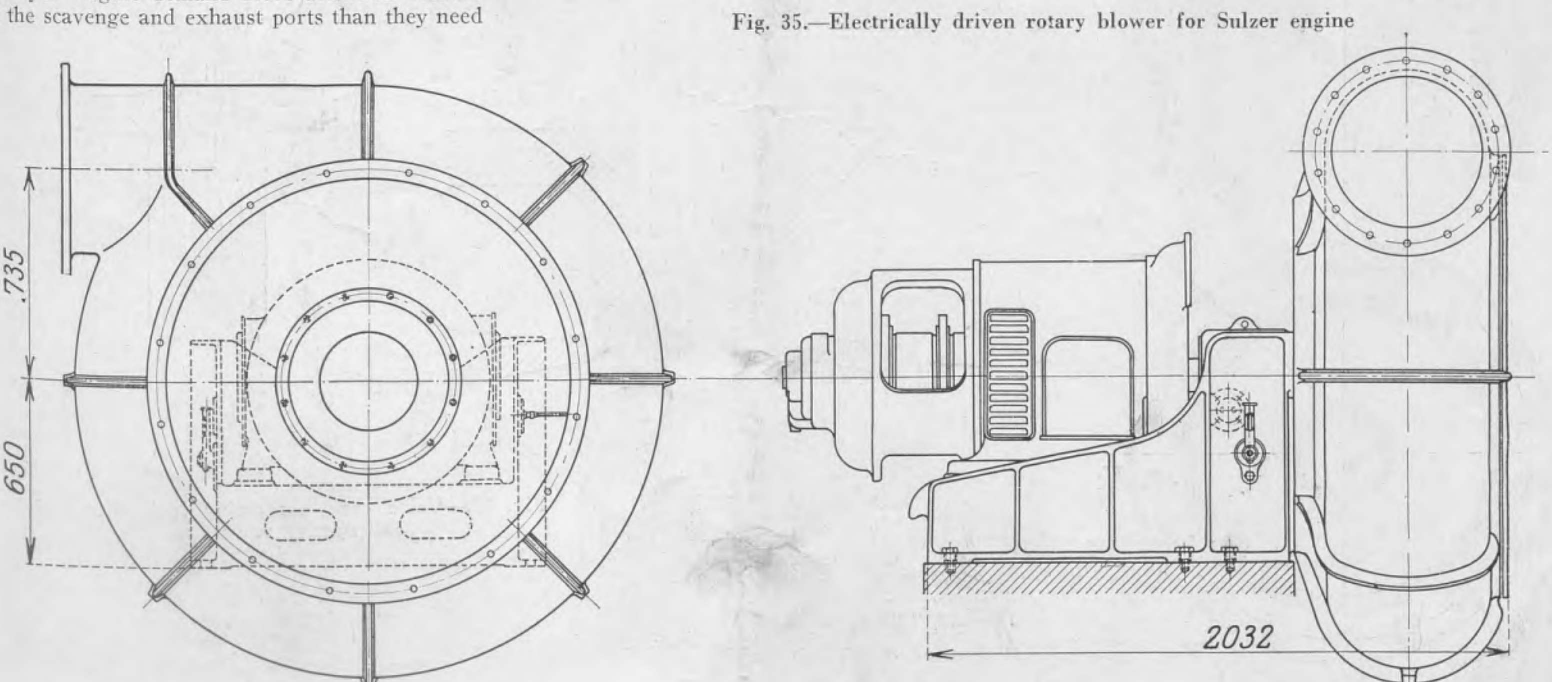


Fig. 36.—Front and side elevations of rotary blower

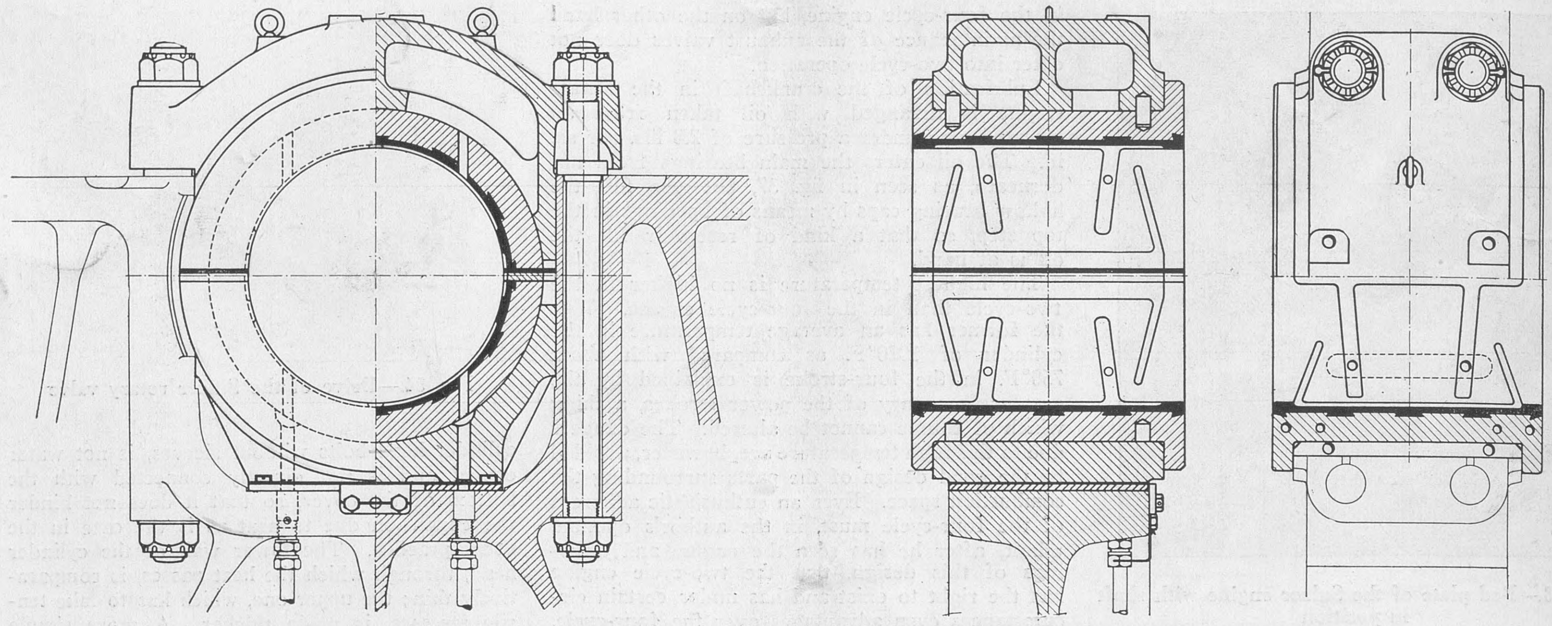


Fig. 37.—Sulzer main bearing, showing oiling arrangements

in ships since 1912 without a single accident. The upper part of the piston, on account of similar construction, is able to withstand the great heat stresses; the lower part of the piston acts only as a slide valve for the scavenge and exhaust ports. The metal between the exhaust ports is cooled both by water and by scavenging air. The packing of the liners in the jackets above and below the ports is effected with three rings of rubber and lead which has proven very successful.

The single valve cage in the cylinder head comprises both the fuel injection valve and the starting valve and also has openings for the safety valve and the indicator (see fig. 39). This cage has its own cooling water system, which enters on the one side above and leaves by means of the small opening on the other side, as seen in the cross section through the cage. In figs. 39 and 40, the latter being a view of the cylinder head from above, are seen a starting valve, which opens directly into the combustion space and is called the inner starting valve, also a second valve known as the outer starting valve, underneath which, on the same spindle is a third and smaller valve which operates as a decompression valve.

The inner starting valve is kept open by means of a cam during the whole of the time taken for starting. The two starting valves act as a double lock when the engine is running on fuel and prevent gases entering the air piping as well as holding back starting air from the combustion chamber. The outer valve, which is opened periodically by the starting cam, is protected by the inner valve from the hot gases and also from deposits, and can be removed when the engine is running in order to be cleaned or ground. The space between the two valves is open to the atmosphere when the engine is running, and thus no pressure can build up there. Burnt gases or starting air that should at any time enter this space would escape and call the engineer's attention to the leaky valve. The compartment between the two starting valves is shut off from the atmosphere by means of the decompression valve, underneath the outer valve, as soon as the latter valve which admits the compressed air into the cylinder has been opened by the rotating cam. This compartment is again opened as the working piston begins to ascend, so that part of the air from the cylinder can escape through the inner starting valve, which is lifted during the whole of the starting process, and the compression during the starting is thus somewhat decreased. Sure starting conditions are thus ob-

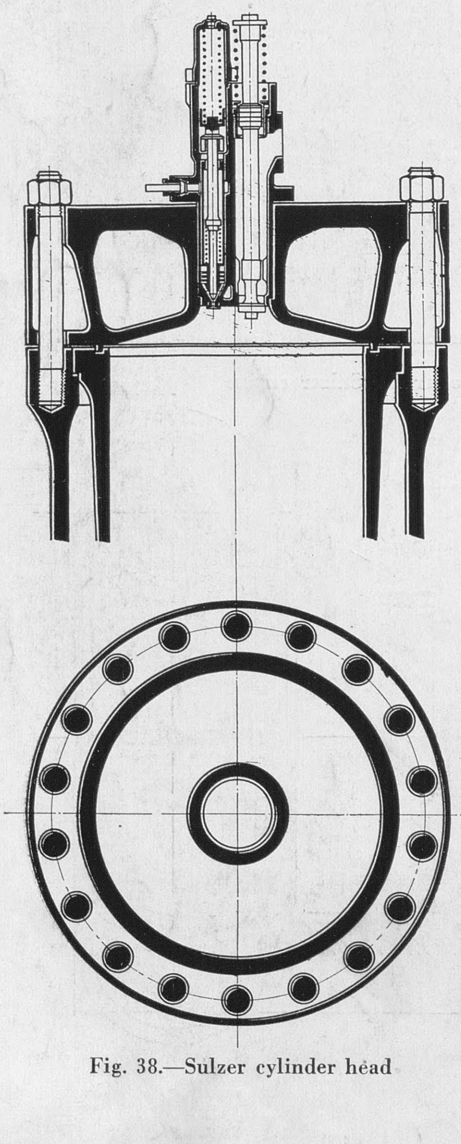


Fig. 38.—Sulzer cylinder head

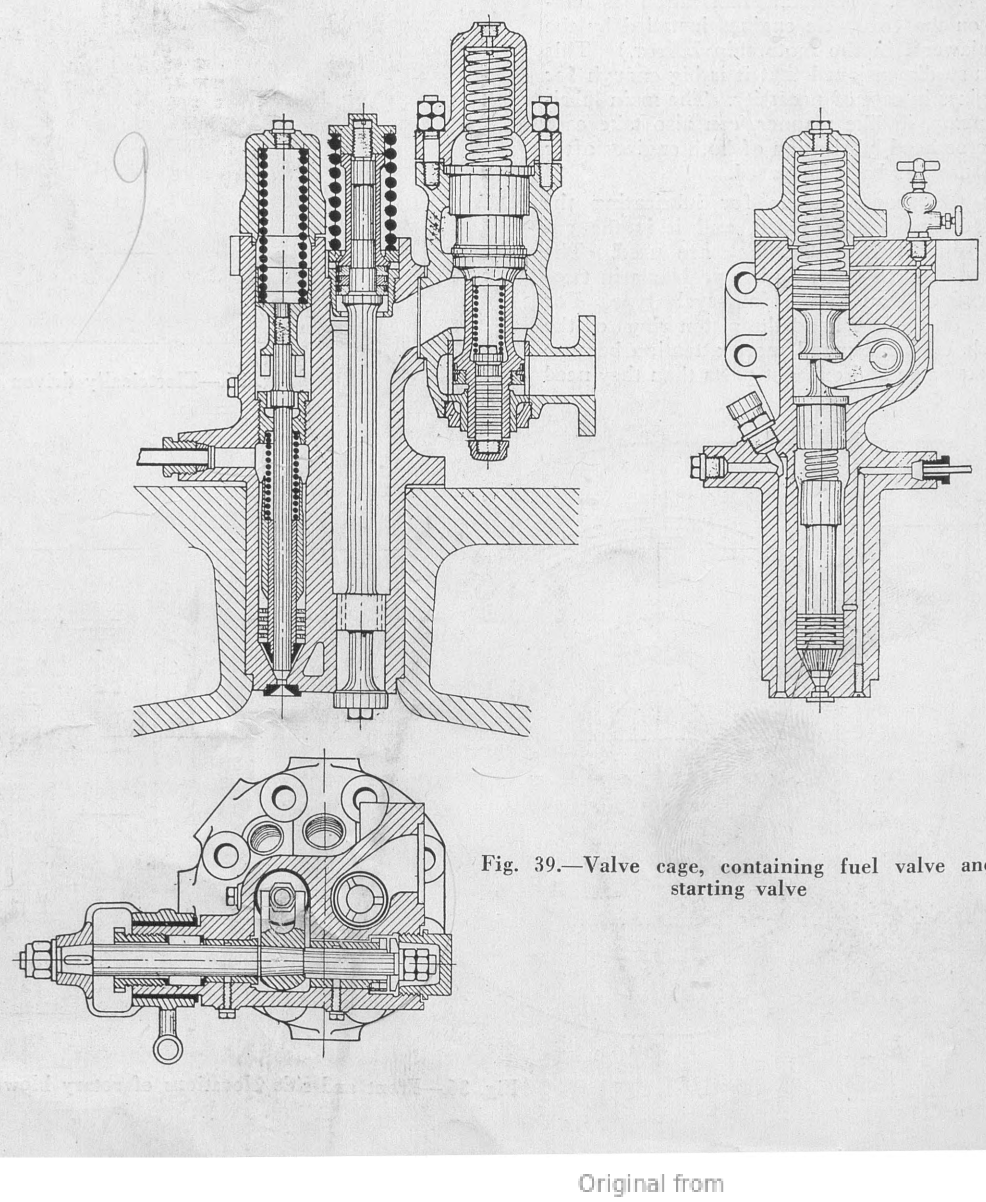


Fig. 39.—Valve cage, containing fuel valve and starting valve

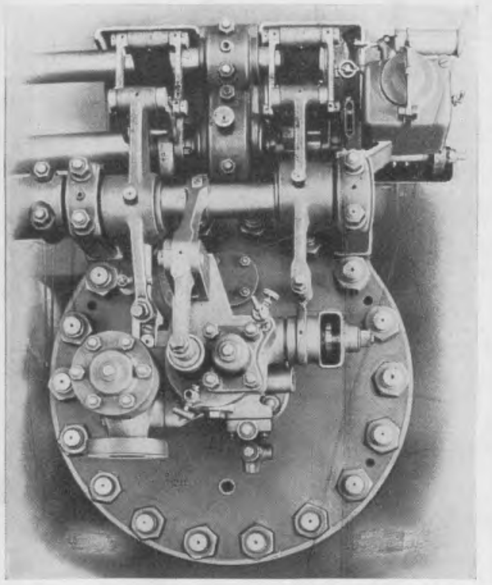


Fig. 40.—View on top of cylinder-head

tained with a very low air pressure. The improved starting method described above facilitates reversing and manoeuvring.

The drive for the fuel inlet valve and the two starting valves is depicted in fig. 41. The lever for the fuel valve engages with a sleeve which raises the needle by means of a horizontal spindle and small lever (see also fig. 39). The strongly dimensioned lever in about the middle of the cylinder head keeps the inner starting valve lifted during the whole of the starting process by means of a cam. The outer valve is lifted from underneath by means of the short lever at the side and a small rocking lever.

Reversing, as shown in fig. 42, takes place by means of an interchange of the ahead and astern cams, but without moving the camshaft. One roller is placed over the ahead cam and one over the astern cam. Both rollers can be made to engage with a link at the end of the valve lever, but only one at a time. The ahead cam engages with the ahead roller or the astern cam with the astern roller, when either is brought into position by means of a hand wheel. Both rollers are clear when the link is in the mid-position. A governor for the injection air is not provided, being unnecessary. A more or less full contact of the roller on the cam ensures opening at about the same angle for slow and high speeds, but a variable period of opening and also variable stroke of the needle. The ahead and astern cams are brought into action by means of a hand wheel, as only small forces have to be overcome. The engineer's platform, the fuel

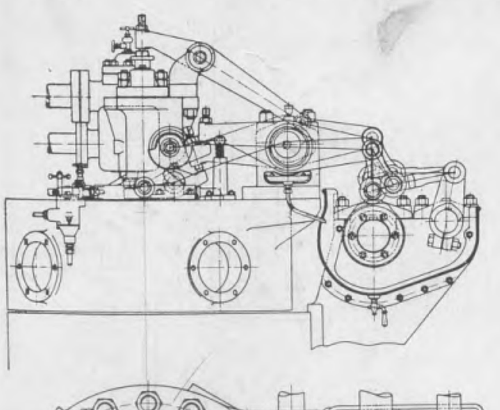


Fig. 41.—Arrangement of Sulzer valve operating mechanism

pumps and the speed regulator (fig. 43) are arranged high up on the engine. Whether this arrangement is an improvement on the old one where the engineers stand below can only be proved by long experience, and is a question which must be decided by the marine engineer rather than by the engine designer.

A part of the frames with the inspection doors opened is shown in fig. 44. The crosshead with its four slide-bars is clearly seen, as well as the lower part of the piston and the telescopic pipes for piston cooling which operate without stuffing boxes and are devised to make a leak impossible. This is of particular importance in two-cycle engines because a horizontal wall between the cylinder and crank chamber can only be arranged at the price of increased engine height, owing to the length of the pistons. The piston rod is not connected with the crosshead by means of a cone and nut, but is fastened by four bolts in order to be more easily removed, as shown in the illustration.

The main bearings (fig. 37) have round brasses which can easily be removed after the crankshaft has been lifted a very little and also pieces with plane faces, with the help of which the crankshaft can be adjusted by means of shims.

Reversing from ahead to astern can be made by means of a small hand wheel as explained above, but a small compressed air engine is provided for turning the valve lever shaft. The same model of compressed air engine is used as a barring engine. When for instance the ship is travelling ahead and the order is given to go astern, then the starting engine is set in motion and disconnects the fuel injection valves and the fuel pumps. The starting engine thereupon automatically disengages itself. When the ahead

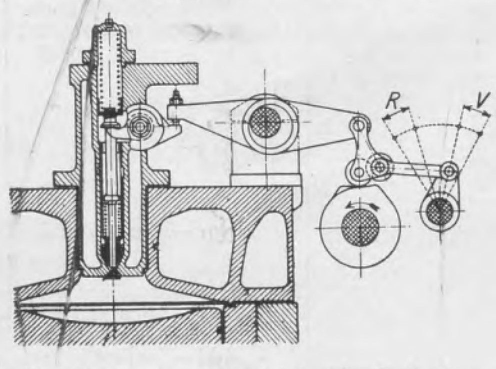


Fig. 42.—Reversing mechanism for fuel valve

rollers have been lifted and the astern rollers brought into contact with their cams, the starting engine is once again coupled up, so that first starting air and later fuel can enter the cylinder.

The engine-room arrangement of two Sulzer sets of 2,500 h.p. each at 85 revolutions is shown in fig. 45. The necessary length of engine room amounts to 66′ 7″ measured at the height of the floor plates. If, however, the two compressors at the fore end of the crank-shaft be placed at the side of the engine, as in the 1600 h.p. M.A.N. engine chosen for comparison, then the length of the engine room will be reduced by more than 8′ 0″. The auxiliary machinery in the fore end of the engine room could then be handily arranged in the free space at the side of one of the main engines. The engine room (fig. 46) for two four-cycle M.A.N. engines each of 1,600 b.h.p. at 100 revolutions is 53′ 2″ long measured as above. The two-cycle engines under discussion would need only 58′ 5″, that is only 5′ 3″ more with the compressors arranged at the side and the same space reserved for the auxiliary machinery, and yet would each give 2,940 b.h.p. or about twice as much as the four-cycle. The breadth of the ship is of course chosen somewhat bigger because of the larger power, being 64′ 8″ instead of 56′ 0″ in the case of the four-cycle. The saving in space with the two-cycle engine is thus considerable, which is true also of the weight.

In a comparison of weights the data on a two-cycle engine of 1,600 h.p. can be given, which was not possible when comparing the saving in space, because an engine-room drawing of two 1,600 s.h.p. two-cycle engines was not available. Two Sulzer engines of 1,600 s.h.p. at 85 revolu-

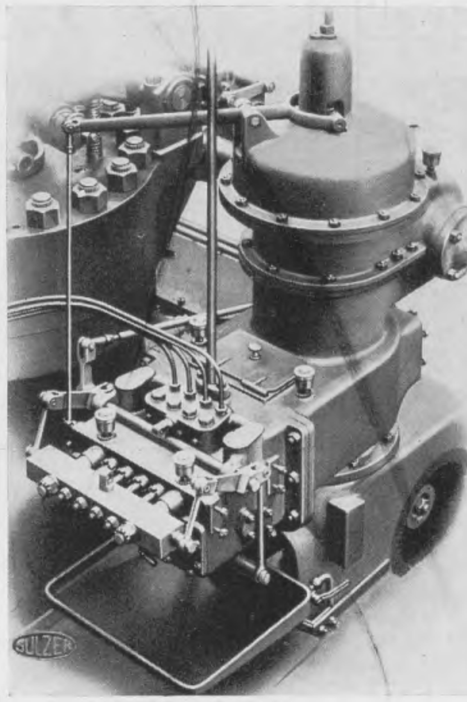


Fig. 43.—Fuel pumps and governor

tions will weigh, inclusive of thrust bearing, flywheel and rotary blower, but excluding the shafting and the other auxiliaries, 424 tons or only 293 lbs. per h.p. The two blowers weigh 12 tons in all, whereas scavenge pumps coupled to the main engines weigh 32 tons, so the weight given above must be increased to 306 lbs., when the latter type of pump is used. The weight of similar four-cycle engines of the same power amounts to about 397 lbs. per s.h.p. when shafting and auxiliary machinery is likewise excluded. Thus the weight saved by the two-cycle type compared with the four-cycle would amount to about 23%. The weights of the two-cycle engines should really be multiplied by 0.85 because of the differences in engine speeds. The saving would then be 43.4%.

Fuel consumption for the main engine, without rotary blower and cooling water pumps,

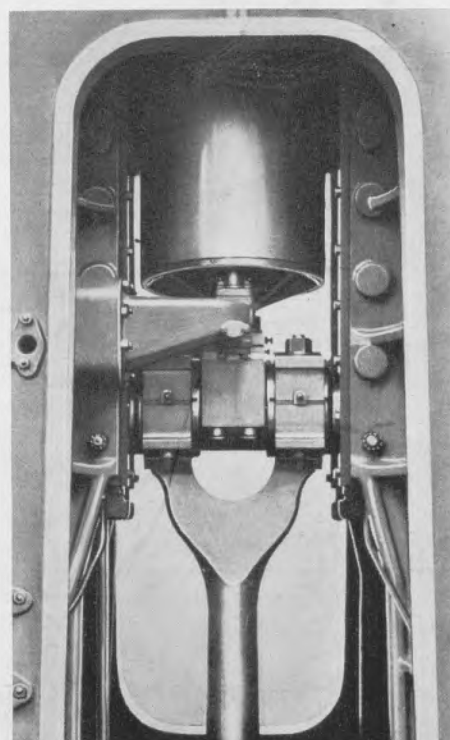
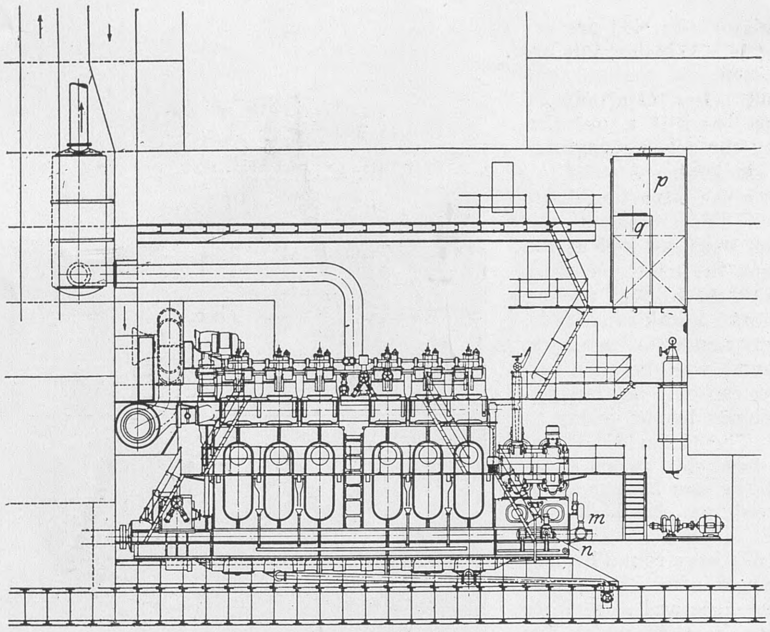
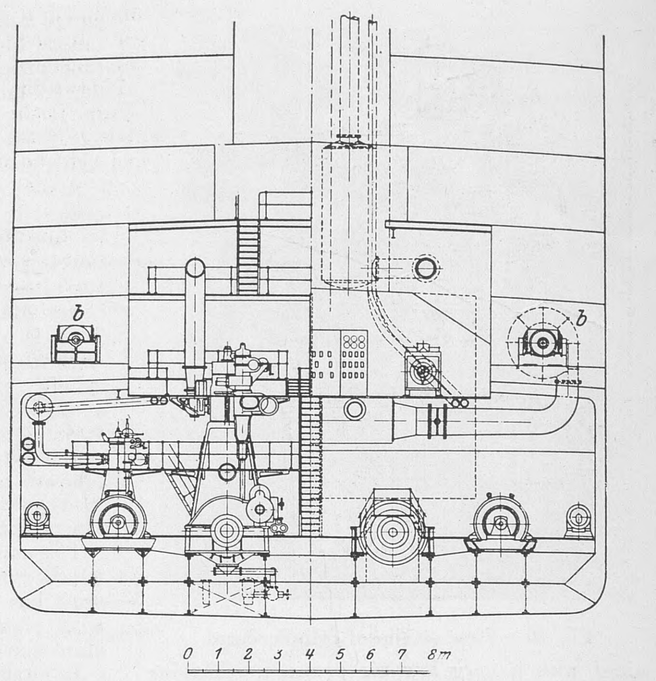
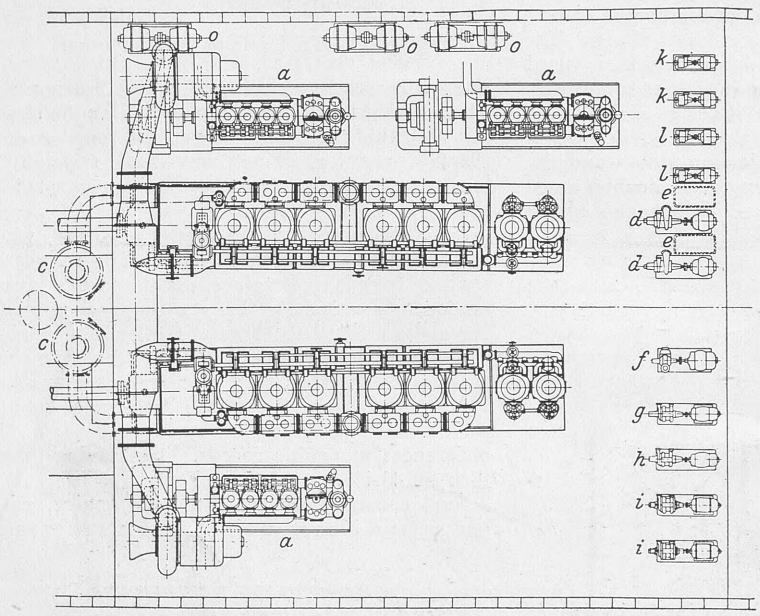


Fig. 44.—Cross-head and guides





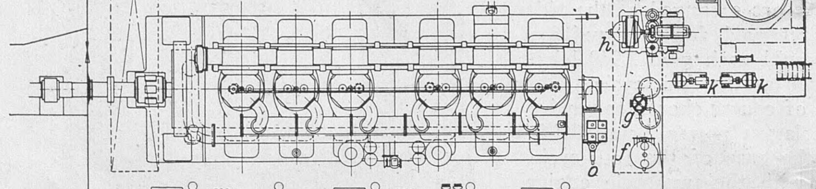


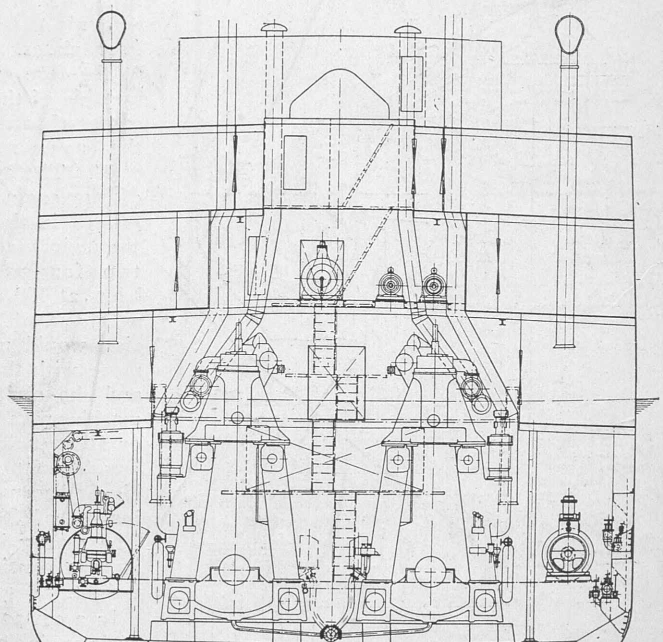
Above and at side—Fig. 45.—General arrangement of engine room with two 2,500 b.h.p. Sulzer engines

aa—Auxiliary engines
bb—Scavenge air blowers
cc—Cylinders
dd—Cooling water pumps
ee—Water filters
f—Ballast pump
g—Fresh water pump
h—Deck pump
ii—Sanitary pumps
kk—Fuel pumps
ll—Drinking water pumps
m—Lubricating oil pump
n—Reserve lubricating oil pump
ooo—Rotary converters
p—Tar oil service tank
q—Gas oil service tank

Below—Figs. 46 and 47.—Arrangement of engine room in a North German Lloyd ship showing two 1,600 b.h.p. M.A.N. type four-cycle engines

aa—Auxiliary compressors
bb—Bilge and fire pumps
c—Ballast pump
dd—Cooling water pumps
e—Tar oil pump
ff—Oil coolers
n & o—Bilge pumps
gg—Lubricating oil filters
hh—Lubricating oil pumps
i—Reserve tar oil pump
kk—Gas oil pumps
l—Donkey boiler
mmm—Diesel engine generator sets





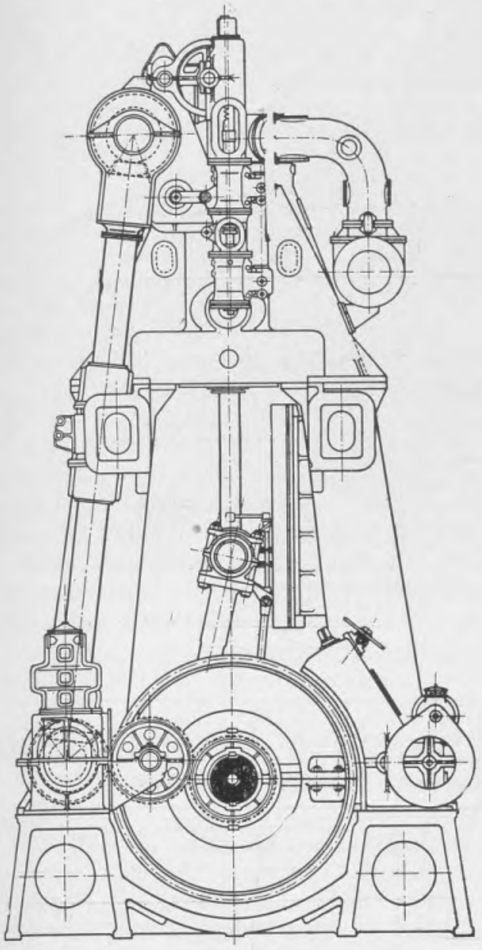


Fig. 48.—End view of Vulcan-Werke engine

amounted to 0.383 lb. per h.p. hr. on a 60-hour test in the works, and was only 0.409 lb. when the auxiliaries mentioned above are taken into account. That is about the same as in a four-cycle engine. The scavenging air pressure amounted to only 1.39 lbs. per sq. in. average, and the power used for the scavenging formed only 4.5% of the effective output.

Lubricating oil consumption is somewhat greater in the two-cycle engines than in the four-cycle, for the reason that the pistons are longer and that the scavenging air in the ports can force some of the oil from the pistons into the exhaust ports.

The advantages of using the two-cycle engine as regards saving of space and weight, and hence first cost, have become so important since the fuel-consumption has been reduced to that of the four-cycle type that the two-cycle engine should be taken into consideration even when it is not a question of engines of large power. The fuel consumption per d.w. ton is less with the two-cycle than with the four-cycle, because a smaller ship is sufficient in the first case and the ship-owner has therefore not only a lower first cost, but also smaller running expenses.

Vulcan-Werke, Hamburg

The Vulcan-Werke have built an 1,800 s.h.p. engine, fig. 50, for a single-screw ship to the order of the Norddeutscher Lloyd, which is also building a similar ship with a reciprocating engine for superheated steam and one with high and low-pressure geared turbines, so that a perfect comparison between the different forms of propulsion will be obtained with regard to first cost and running expenses.

The Vulcan-Werke is a licensee of the M.A.N., and the design of the engine is therefore in principle the same as that of the 1,600 s.h.p. M.A.N. engine already described. A cross view of the middle part of the engine looking aft is shown in fig. 48, where the drive of the camshaft is particularly clear. The geared auxiliary shaft on the side of the engine drives through bevel gears a second shaft inclined upwards. A third shaft drives the camshaft at half speed by means of other bevel wheels. A coupling to admit the axial displacement of this shaft, which otherwise could influence the operation of the bevel wheels, is placed at the upper end of the inclined shaft.

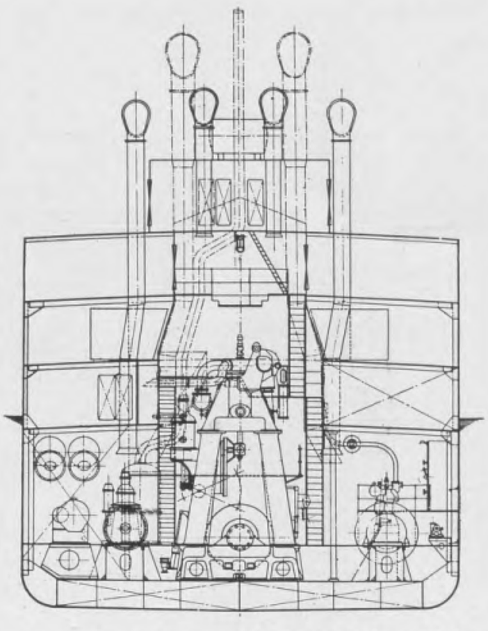


Fig. 49.—Engine-room with 1,800 b.h.p. Vulcan-Werke engine

Both the compressors, which are arranged at the exhaust side of the engine, are driven by levers. The compressors, as well as the suction valves of the main cylinders, take air from a chamber arranged on the port side of the engine room and leading to deck. The engine room does not therefore become so cold during cold weather, and the condensation of the wet sea air is much reduced.

The operation of the reversing gear of this engine was described and illustrated on page 191 in the March issue of Motorship.

The winches, pumps and steering engine of the North German Lloyd ship are all electrically driven. Two dynamos each of 90 k.w. and 220 v. are driven by Diesel engines, either of which is

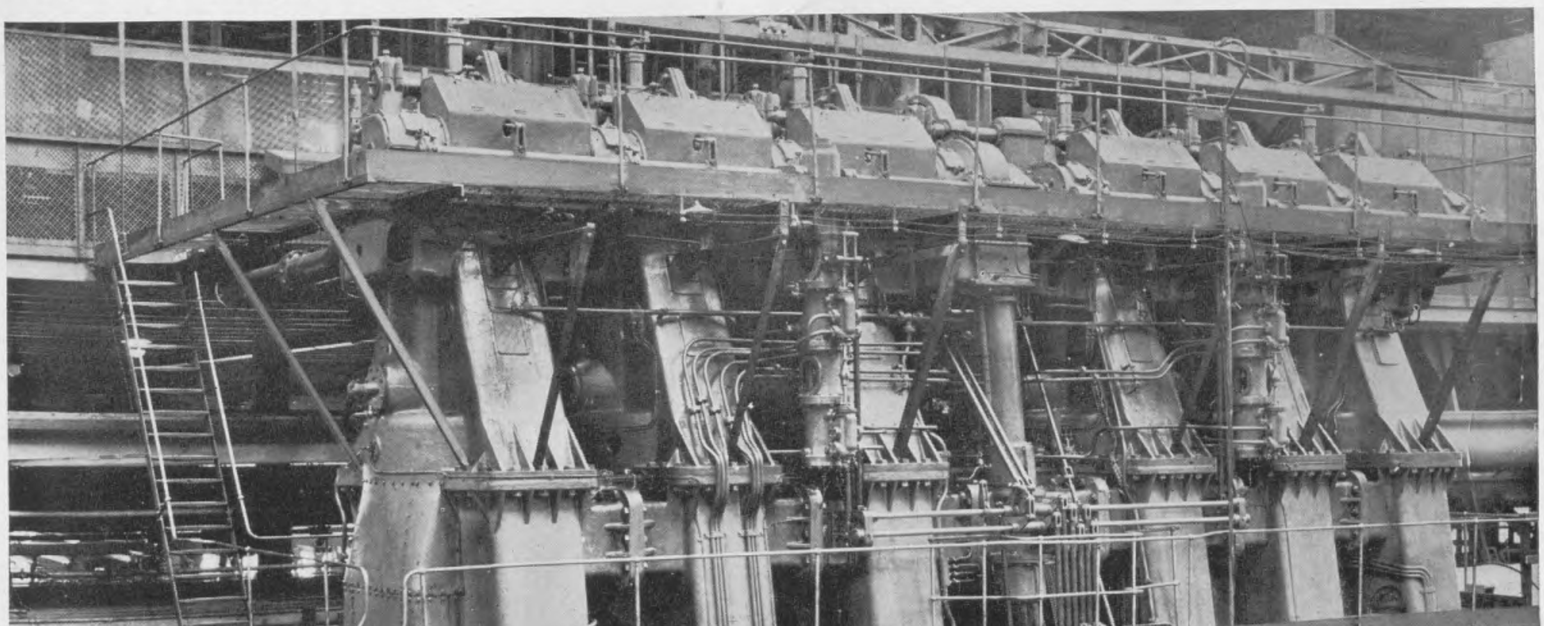


Fig. 50.—Vulcan-Werke 1,800 b.h.p. engine of the M.A.N. four-cycle type

sufficiently big to deliver the power required when at sea.

The fuel consumption amounted during the tests at the works to an average of 0.4 lb. per s.h.p. hr. at 1,800 s.h.p. and 100 revolutions per minute. In fig. 49 is shown the arrangement of the main engines, auxiliary machinery and fuel tanks. The auxiliary boiler is only for heating purposes.

A.-G. Weser, Bremen

A cargo ship with two oil engines each of 1,600 h.p. is at present being built by this firm for the Norddeutscher Lloyd. One of these engines has been built by the M.A.N. in Augsburg, and the other exactly similar engine by the A.-G. Weser, which is a licensee of the M.A.N. The M.A.N. engine has been discussed in detail at the beginning of this paper, and nothing new remains to be said about the engine built by the A.-G. Weser.

Figs. 46 and 47 show the arrangement of the engines in the ship. The following auxiliaries are provided: three 220 v. dynamos driven by Diesel engines of 120 b.h.p. each at 300 revolutions per minute, arranged in line on the starboard side; further two electrically driven centrifugal pumps for the cooling water and two more electrically driven pumps for the forced lubrication, which are all placed in the fore end of the engine room. One of each kind of these pumps is sufficient for both the main engines, so that the others serve as reserves. A fuel pump for taking the oil on board ship and two electrically driven auxiliary compressors are to be found aft on the port side of the engine room. A surface ignition motor of 15 b.h.p. is arranged on the main deck, driving a 10 kw. dynamo and also by means of a special coupling serving to drive a reserve compressor. The winches and the steering engine are all electrically driven. An oil fired boiler is provided for heating purposes only.

The A.-G. Weser has a second twin-screw ship building for the Norddeutscher Lloyd, for which the line has bought two Sulzer engines each of 2,500 h.p. which the A.-G. Weser is to build into the ship. These two engines were originally ordered by other shipowners for a vessel which a Hamburg shipbuilding yard had on order but which was later cancelled.

DIESELS DISCUSSED BY VEREIN DEUTSCHER INGENIEURE

(*Continued from page* 551)

in these engines was assisted by eddies set up by the working piston, or with the aid of an ignition chamber. By a calorimetrical investigation of different engines, the value of temperature can be determined with air injection and airless injection respectively, during the periods of combustion and expansion. In connection therewith, the heat can be measured which passes to the cooling water during that part of the cycle. It has been demonstrated that the mean rate of transmission of heat is greater with air injection than with airless injection, because of the smaller eddying effect obtained when blast air is in use.

A paper on fuels and their combustion in the Diesel engine was read by Mr. Alt, the chief engineer of Krupp's, at their Kiel shipyard. He dealt at length with the theories of combustion within the Diesel engine based on recent investigations. The former ideas about combustion, holding that the ignition of the fuel injected into the highly heated air of the combustion space is preceded by a certain degree of vaporization and that the different behavior of fuels in the engine are accounted for by differences in their vaporization, are not in line with the most recent practical knowledge.

It has been ascertained that the atomized fuel ignites directly without any prior vaporization. The difference in the behavior of fuels in the engine must be laid to differences in their molecular composition. It appears that combustion should preferably be carried out in such a way that no vaporization of the fuel takes place, because vaporization is generally accompanied by a decomposition causing the formation of soot and coke.

Increasing the power of four-cycle engines was the theme treated by Dr. Riehm, the chief engineer of the Augsburg works. Starting from the thought that large cylinders give rise to considerable problems of a constructional character, he suggested that insomuch as the heat stresses in a four-cycle engine are considerably lower than in a two-cycle engine of similar dimension, it is worthy of investigation whether the effective piston pressure cannot be increased without detriment in the four-cycle engine. This can be effected in a simple manner by introducing a greater quantity of fuel into the regular air charge of the working cylinder. The problem of burning this fuel in the given weight of air as completely as possible requires a greater energy of injection, either by increasing the blast pressure or by supplying additional atomization air through a special valve. Tests of this method have shown, however, that with increasing piston pressure, both the fuel consumption and the heat stresses increased rapidly. This method can, therefore, only be adopted for temporary increases of power.

Better results are promised by pre-compressing the ordinary air charge of the cylinder. Combustion then takes place approximately between the same limits of temperature and between the same limits of pressure as with the regular engine. The pre-compressed air can be supplied by a blower. Tests have shown that an increase of power ranging between 30 and 50 per cent. can be obtained in this way, with only a slight increase in the specific consumption of the fuel. The heat stresses of the walls are increased only in small measure. Most favorable results are obtainable if one utilizes the energy of the exhaust gases for driving a centrifugal compressor by means of an exhaust gas turbine. This has already been tried out with aeroplane engines, and has met with considerable success in maintaining the power of the engines at high altitudes.

GERMAN MOTOR SALVAGE BOAT

A powerful tug was recently completed in Hamburg for the Bugsier, Bergungs und Reederei A.-G. She is 130 ft. long, by 22 ft. 9 in. beam and 13 ft. depth, with a draft of 10 ft. 1 in. She was designed for strenuous service conditions, with the fore deck higher than the main deck and a good sheer forward Her lines were obtained after test in the experimental tank at Hamburg. The propelling machinery, which consists of two four-cycle Diesel motors of the submarine type, each with six working cylinders of 13¾ in. diameter and 14⅛ in. stroke, developing 1,400 h.p. at 400 r.p.m., gives her a speed of 14¼ knots. These engines were formerly of the non-reversible type, but we understand have been rebuilt with reversing mechanism. There are two auxiliary Diesel generating sets driven by Benz airless-injection engines, and the auxiliary compressors can be hooked up with these sets. The salvage pumps, steering engine and anchor winch are all electrically operated.

With a daily fuel consumption of 6 tons, this boat, which has a bunker capacity of 90 tons of fuel, has a cruising radius of about 5,000 miles. She will be stationed on the River Elbe when not in service, and has been designed with sufficient engine power to beat all her steam competitors, in which she will be assisted by her readiness to proceed to sea at full power within a few minutes of receiving orders. A motor lifeboat is carried aboard.